

THE
AQUEDUCTS OF
ANCIENT ROME



Thomas Ashby

THE AQUEDUCTS OF ANCIENT ROME

BY
THOMAS ASHBY

Edited by
I. A. RICHMOND

*Aerii montes, et vos quae montibus ortae
curritis, humanus quo vocat usus, aquae,
lugete artificem qui vos celebrabat ademptum
fertile doctrinae dum manus urget opus.
mors opus abruptit : duxit manus altera rivos,
ne sua non veniat laetus in arva liquor.*

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BEFORE my husband laid down his pen for the last time, and answered his call to higher service, he had finished his long work on the Roman Aqueducts. It is no secret that he considered this to be the crown of all his life's work, and that his great wish was to finish it successfully and to see it published. Only the first part of his wish was granted him; it has been left to me, his wife, to carry out the second.

The aqueducts were to him the most engrossing of all Roman antiquities, and the present volume is the fruit of many years of patient study and research, of many happy Campagna expeditions with kindred spirits in Roman worlds, and of many, many, busy hours in his home among his books. It is associated too with our own happy companionship in work, as I was privileged to help him in my very small way. So, it will be easily understood that the 'aqueduct book' was especially dear to us both.

After he had gone I was left with the manuscript and the trust that I would see it through. It had already been accepted by the Clarendon Press, but it was necessary to prepare it for publication, and this task has been most happily completed by Mr. Ian Richmond, our good friend and former pupil of my husband. So now *The Aqueducts of Ancient Rome* is given to the world in commemoration of the dear husband, friend, and scholar whose work it is.

MAY ASHBY

... I knew that even in going to the abode of the dead he was not going without the protection of the Gods, and that when he arrived there it would be well with him if ever it was well with any one.... So that it was not for him that I wept: I wept for myself, in losing such a friend.

PHAEDO, 58e, 117e.

EDITOR'S NOTE

THE bibliographical researches of Dr. Ashby reveal that a curious fate has attended the great topographical studies of the aqueducts of ancient Rome. Lucas Holste (*ob.* 1661), Raffaele Fabretti (*ob.* 1700), and Diego Revillas (*ob.* 1746) all planned works of importance on the subject. All died before their work had been committed methodically to paper. Thomas Ashby was more fortunate. Three weeks before his death, which occurred on 15 May 1931, he had deposited with the Clarendon Press the manuscript of a topographical study in 925 foolscap pages.¹ He had envisaged this task before 1908, and it is well known that he considered it to be his life-work. In 1925 he was frequently referring to it in these terms in conversation with the writer, and speaking of the need to get it finished. His presentation of the subject, as President of the Anthropological Section of the British Association for the Advancement of Science, in 1925, provided a stimulus which completed the bulk of the work three years later.

It was essential that some one familiar with Dr. Ashby's work and with Roman remains should see the manuscript through the Press, and the choice of the Delegates and Mrs. Ashby, falling upon the writer, was accepted by him as an opportunity to repay the teaching of a master and the kindness of a friend. The aim of this edition is to present the text as Dr. Ashby wrote it, only carrying out the linguistic revision which proof-reading might suggest; and it has been found possible to fulfil this object almost completely. But the arrangement of the manuscript, and the contents of two sections in Part I, have been revised on lines suggested by a research into the construction of the work.

A clue to the composition was secured by analysing the many systems of pagination that preceded the final consecutive numbering of the manuscript. Part II, containing the topographical descriptions of each aqueduct, is the most important and the least changed. Each section in this part was written independently and originally numbered thus. Only the account of the Claudia, numbered 62-166, was evidently combined with a lost version. The account of the Anio Vetus incorporated odd pages of an older version, and that of the Aqua Virgo had received a drastic revision. Again, when these sections were first arranged as a consecutive series, numbered with blue pencil, the order was Appia,

¹ Ashby usually wrote on the left-hand half of the page only, leaving the right-hand half free for additions and notes. Many pages are also very scantily filled. But two hundred and thirty-eight leaves were written by Mrs. Ashby, whose share in the labour of penmanship was thus a notable one; these pages are full pages with notes at the foot.

Marcia, Tepula, Iulia, Virgo, Alsietina, Claudia, Traiana, and Alexandriana, suggesting that the descriptions of the Anio Vetus and Novus were not yet available. Finally, Dr. Ashby arranged them all in the order of each aqueduct's erection. The accounts themselves, once written, remained substantially the same; and this fact, if the bewildering quantity of intricate material is considered, is a remarkable testimony to Dr. Ashby's unequalled mastery of this branch of research.

The Introduction and Commentary, Part I, had a more complicated evolution. The principal recension was paged with a blue numbering, to fit the first co-ordination of the whole manuscript, not earlier than 1928. There was an earlier arrangement, numbered in black pencil, consisting of an historical introduction, already once revised, as yet another pencilled pagination showed, and the bibliography, then wanting its earliest material. The blue-pencilled recension, preserving this order, added bibliographical notes on Belgrand, De Montauzan, and the *Livellazione*, with special reference to engineering problems; an account of the author's own work; and appendixes on the *cippi* and the gradients. The engineering notes were transferred from an earlier version, in which they had been nearer the beginning in an unknown context. This was followed by an entirely new numbering, covering a lengthy preliminary now lost, whose surviving tail included the end of the original historical sketch. Then occurred new notes on Frontinus, other *curatores*, and their staff; and a miscellany on construction and repairs. The bibliography was ejected from its early position, together with all other material not so far used. The final pagination, the basis of the present text, retained the historical introduction of the blue-pencilled grouping; added to the note on Frontinus a very mixed set of leaves, of undefined antecedents; retained the version of the *curatores* and their staff; interpolated scraps of material in the miscellany; reshuffled the engineering section; and, finally, placed the bibliography as an introduction to Part II, by this time in final order. Part I can thus be shown to have sprung from a short preface, containing historical sources and bibliography, the minimum required to introduce the topographical study. The *Livellazione* prompted the reference to the engineering problems, furnished with technical appendixes. The Loeb edition of Frontinus inspired the insertion of material from the *de aquae ductu*, including a constructional miscellany designed to precede the engineering section and appendixes, now divorced from the bibliography. In short, the Introduction, originally planned to be simple, grew into a large and rather amorphous series of notes. Dr. Ashby had done no more than place them in order, and

clearly intended to co-ordinate them when the first stage of printing should have rendered this bulky section more manageable; for in the winter of 1930-1 his health was not good, and he was possessed with an instinctive urge to get the work into the printer's hands.

The present writer, having made this study of the composition, did not hesitate to rearrange¹ Part I. The historical introduction is now followed by the account of the *curatores* and staff, and these sections are presented substantially as Dr. Ashby left them. But the frequent transposition had so confused the sections on Frontinus and engineering as to demand their recasting. Accordingly, the notes on Frontinus and his reforms were arranged to form one distinct section; while Frontinus and other ancient authors have been combined with modern notes in an attempt to define the principles on which the Rome aqueducts were planned. These sections are the editor's own work, arranged so as to treat such questions as Dr. Ashby's notes considered. The graceful verses on the title-page by Mr. T. Higham, of Trinity College, have also been added, as a tribute to Dr. Ashby's memory.

For illustrations not included by Dr. Ashby we are also indebted to Professors Axel Boethius (pl. iii *a*) and Giuseppe Lugli (pl. vii *a*), and to Mr. W. G. Holford (pl. xvii).

The exact character of the few changes thus being defined, it remains to say that they were not made without compunction, outweighed by desire to include all the subjects which Dr. Ashby's broad view of the subject had induced him to treat, and by a determination that the revision of work done in weakness should contain at least something belonging to the work done in strength. The same standards have been applied to the minor revision, altering no pronouncement and, except in sections already specified, introducing no new material. Dr. Ashby himself had written no preface. His account of his own work and its aims has therefore been removed from the subordinate position where his modesty had placed it, and now serves as the preface for his book. Its closing words will read with a certain pathos: but they have been retained, implementing his wishes and explaining why a posthumous edition of his greatest work is not dedicated in print, as it must be in the hearts of all his friends, to THOMAS ASHBY.

¹ It need hardly be said that all rearrangement was carried out in a copy of the original manuscript, which has been left exactly as the editor received it.

PREFACE

IN regard to the aqueducts of the City of Rome, what I wrote twenty-five years ago may, I think, still stand. 'It is a curious fact that the monuments of the power of Rome in the remotest borders of her Empire are in reality better known than those that lie at her very gates. . . . That the aqueducts should have shared in the general oblivion is somewhat remarkable. Considering the fame which the arrangements for the water-supply of ancient Rome justly enjoyed—a Greek writer of the Augustan epoch¹ speaks of the aqueducts, the roads, and the drainage system as the most striking of the public works of the City—it is noticeable that they have not formed a subject of study for more recent investigators.'

Before these words were written I had hoped to secure the co-operation of the late Professor Howard Crosby Butler,² but work at Sardis claimed his energies instead. Presently I published, in the *Builder* for 1908,³ a general description of the whole course of the four great aqueducts from the valley of the Anio. In 1912, I went over the whole line of these four aqueducts with the late Mr. F. G. Newton, who made architectural drawings of the most important remains. These serve as text-figures in this book; and I am deeply indebted to him for the care with which he worked out the difficult problems connected with the various periods to which the successive reinforcements belong, and for many days of useful and pleasant companionship. It would have been a great advantage if we had then been able to refer to a careful levelling of their course, the necessity of which had long been apparent.⁴ But only in 1915 was a thorough survey of the remains then known to me carried out by the late Professor Vincenzo Reina, Professor of Geodesy at the Engineering School in Rome, and his assistants, Ingegneri Guido Corbellini and Guglielmo Ducci.

The portion of the aqueducts from Rome to Pallavicina was surveyed by Ingegnere Corbellini, after I had been over the whole ground with him and Professor Reina; while from Pallavicina to the Osteria della Spiaggia, below the railway station of Cineto Romano,⁵ the survey was conducted by Professor Reina and

¹ *Strabo*, v. 3, 8; C. 235.

² He published a short article on the subject in the *American Journal of Archaeology*, v (1901), 175.

³ Vol. xciv (1908, i.), pp. 37, 64, 89, 111, 142, 174, 203, 234, with 29 illustrations. Short articles in *Neue Jahrbücher*, xxiii (1909), 246 ff., and *Public Works*, ii, part 3 (1904), 193 ff., may also be noted.

⁴ I brought forward a recommendation to that effect at the International Congress of Archaeology and the History of Art in 1911. A few slight discrepancies between Mr. Newton's sections and the figures given by Professor Reina are inevitable.

⁵ From this point to Subiaco remains are scanty, and belong only to the Anio Novua.

Ingegnere Ducci, whom I accompanied constantly in these expeditions of which I have the pleasantest recollections. My debt of gratitude is very great: among other advantages, it now became far easier to assign the remains correctly where the course of two or more aqueducts was more or less identical. Their results were published in 1917,¹ and, on the technical side, form the basis of what I have written;² and the maps prepared by Ingegnere Ducci for their monograph are given in the present work, an extra number having been printed at the same time by the Istituto Geografico Militare.³

In 1925, with Dr. Esther Van Deman and myself, Mr. G. R. Swain, photographer to the Near East Expedition of the University of Michigan, visited all the most important remains of the aqueducts, and, despite adverse weather conditions, secured a most valuable series of fine photographs, which has been drawn upon for the illustrations to the present volume, with the kind permission of the Near East Research Committee of the University of Michigan. In the same year in my presidential address to Section H (Anthropology) of the British Association at Southampton I gave an account of results reached up to that time.⁴

In elucidating the chronology and construction of the aqueducts, and especially of the various bridges by which they cross the branch valleys of the Anio and the deep ravines between Gericomio and Pallavicina, I have relied upon the dating established by Dr. Esther B. Van Deman's⁵ work, *The Building of the Roman Aqueducts*. How much the present work owes to her will be gathered partly from the frequency with which her name is cited; but long days of study together in the field and at home constitute a debt which ordinary forms of acknowledgement cannot properly express.

The present book does not pretend to be a second edition of Lanciani's great work on the aqueducts, *I comentarii di Frontino intorno gli aquedotti*, published in 1880.⁶ His first chapter, on

¹ 'Livellazione degli antichi acquedotti romani', in *Memorie della società italiana delle scienze detta dei XL*, serie 3, vol. xx (1917).

² Unfortunately, owing to the delay caused by War, I was unable to go over the line of the aqueducts until some years after the levelling had been completed: and by that time the red paint showing the position of the bench-marks had entirely disappeared, so that they were not always easy to find.

³ I owe certain additional levels to Ingegnere Amedeo Nosei, assistant to Professor Guido Cicconetti, the successor of the late Professor Reina.

⁴ *British Association, Report of the Ninety-third Meeting*, 1925, 144 ff.; cf. *Illustrated London News*, 9 July 1921, p. 46, for preliminary notes at the Cardiff meeting.

⁵ For a preliminary account of the results of her studies in the chronology of Roman concrete monuments see *American Journal of Archaeology*, xvi (1912), 230-51, 387-432. About the dating of ashlar considerably less is as yet known.

⁶ *Memorie dei lincei*, serie 3, vol. iv (1880), pp. 213 ff; and separately. I have given both pagings when quoting, henceforward as *Lanciani*.

the Tiber and the springs which rise in the City of Rome, might have been amplified in some details; but more recent information on the subject appears in any work on the topography of Rome.¹ Nor is there enough material to add to Lanciani's last six chapters to justify an attempt to revise and rewrite them. It would be waste labour to anticipate what must surely appear before long, the concluding portion (with indexes) of the fifteenth volume of the *Corpus Inscriptionum Latinarum*, in which the inscribed water-pipes, as well as the brick-stamps, of Rome and its neighbourhood are published; and the text of the inscriptions on the pipes themselves, with valuable introductory remarks, are already given in that work sufficiently well. Finally, though Lanciani attempted some discussion of aqueducts in general in the last two chapters of his work, it must be frankly confessed that, without wider travel over the Roman world, I should not venture further with any hope of justifying the attempt. Some comparative study has been done by Herschel, and still more by De Montauzan, and this may yet throw light on the aqueducts of Rome. But, in the author's judgement, many of the problems which confronted the builders of Rome's aqueducts were different, and were dealt with differently, from those to be solved elsewhere in Italy and the provinces.

For these reasons, it seemed better to limit this treatise to the study of the eleven main aqueducts of ancient Rome.² The advance in our knowledge of these since Lanciani wrote in 1880 has been considerable, and is in very large measure due to Lanciani himself: for, as I pointed out long ago, it was Lanciani's suggestion that we should search for the deposit thrown out at the *putei* of these aqueducts, and this made it possible to track them from Gallicano till they emerged on arches at Capannelle. In that work, then, Lanciani himself had no small share,³ and to his memory this book is duly dedicated, now that the hope of presenting it to him during his lifetime can no longer be realized.

THOMAS ASHBY.

ROME,
April 1931.

¹ Details and references will be found in Platner and Ashby, *Topographical Dictionary of Ancient Rome*.

² What is to be said on *Aquae Octavia* and *Augusta* in the Alban hills will be found in my description of *Via Latina* (*PBSR.* v. 232, 265, 388, 394). The *Marrana Mariana* is spoken of below; pp. 127, 222.

³ *Classical Review*, 1900, 325-7 for a short preliminary account of our results by the present writer. The fortunate chance that the farm road leading to the *Casale della Pallavicina* should have cut through a part of the channel of the *Aqua Claudia* was what first directed Lanciani's attention to the possibility of recovering the course of the aqueducts in this district.

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GLOSSARY

- anathyrosis*: fitting stone blocks by cutting an exact edge on each bed and hollowing the main surfaces, leaving only the margins to make contact.
- capanna*: a peasant's shieling, in field or vineyard; cf. Isid. *Orig.* xv. 12, 2.
- caposaldo*: a surveyor's main point of reference, or bench-mark.
- cappellaccio*: a soft inferior tufa, local to Rome.
- casello*: a lineman's house, set at each kilometre of the Italian State Railways, and numbered with kilometric and registration numbers, as 55·349.
- cut-and-cover*: To make a conduit by setting its sides in parallel trenches, removing the earth between them and covering the resultant void.
- Grotta oscura*: a quarry on *Via Tiberina*, still yielding a yellow, coarse-grained tufa, much used in Republican Rome for facing, but later reserved for aggregate.
- opus incertum*: a modern term, derived from the *genera structurarum* of Vitr. ii. 8, meaning a facing of small irregular rubble, applied to concrete walls, and much used in Latium under the later Republic.
- opus mixtum*: an entirely modern term for successive courses respectively of stone or tile, used to face concrete walls in varying or regular order and common in Rome after the fourth century A.D.
- opus quadratum*: the Roman term for squared masonry, or dimension stone.
- opus reticulatum*: a modern term derived as *opus incertum*; this was a regular rubble facing of cubes set diamondwise, applied to concrete walls like a net (*rete*), and common in Latium from the time of Julius Caesar to that of Commodus.
- opus signinum*: the Roman term for a smooth waterproof coating, used on floors and walls, of crushed tiles or *amphoræ* and cement. The Italian term is *cocciopesto*.
- peperino*: A grey tufa, peppered with granulations.
- selce*: grey flint-stone (Lat. *silex*), much used for ancient paving.
- sperone*: a grey-green tufa from near Gabii, very like *peperino*.

PART I
INTRODUCTION

EARLIER TOPOGRAPHICAL STUDY

THE first observer to deal with the topography of the aqueducts after their ruin was Flavio Biondo,¹ who describes an expedition of Pius II and his Court, on 7 September 1461, to the summit of Monte Affliano. They descended by the shorter and steeper route on the west flank, and Biondo speaks at some length of aqueducts in Valle d'Empiglione and along Via di Carciano. His description of the former is quite recognizable, without adding to our knowledge, but his topography is sometimes at fault; for example, he confuses Aquae Marcia and Alsietina. The same Pope Pius II also mentions the remains in his *Commentaries*,² as follows: 'there are meadows in a secluded valley (Valle d'Empiglione), watered by many springs, two miles from Tivoli, across which the water-supply, which was once derived from the Anio, was carried by very lofty arches to the hills facing Rome; whence it was conveyed by subterranean channels either to Hadrian's Villa or to Rome. There still exist massive remains of the aqueducts, though interrupted, and their ruins show to-day how much was expended in their construction.' This interest was not academic but practical, for efforts to bring the aqueducts into use once more were already being made. Attempts to repair the Aqua Virgo began under Nicholas V, but were not really successful until the time of Pius V. It was in fact Sixtus V whose Acqua Felice brought the springs of Aqua Alexandriana to Rome, and made it possible to reside once more on the hills, giving him in a very real sense the right to be considered the true founder of modern Rome.³ Apart from Aqua Virgo, the aqueducts were little studied by Renaissance antiquarians and architects, Sallustio Peruzzi being among the exceptions.

Topographical studies begin in earnest with Philip Cluver,⁴ who, however, says little on aqueducts. More is derived from Lucas Holste, the German librarian of the Vatican Library, whose extensive knowledge of the neighbourhood of Rome, and indeed of most parts of Italy, survives in fragments; namely, his annotated copy of Cluver,⁵ maps and notes found among his

¹ In a letter first published by Cascioli in *Boll. di Tivoli*, i (1919), 128 ff., from a copy by Nogara, who also gives it in *Studi e testi*, 48, 193 ff.

² v. 138 (ed. Ghibellini). ³ Orbaan, *Sixtine Rome*, 11 ff. ⁴ *Italia antiqua*, *passim*.

⁵ This is in the Barberini collection at the Vatican, *Stamp. Barb. E.E.E.* vii. 21-5. It is bound up in five volumes, at the end of which are a number of valuable contemporary maps (see Almagia, *L'Universo*, 1927). The notes were printed after his death by Cardinal Carlo Barberini, as *Annotationes in Italiam antiquam Cluverii*, &c., Rome, 1666.

papers,¹ and his diary, now preserved at Dresden.² His early death, in 1661, prevented a publication of the highest value.

Holste was followed by Raffaele Fabretti of Urbino,³ whose treatise on the aqueducts of Rome, published in 1680,⁴ is not only the first book devoted exclusively to the topic, but is among the most valuable works on the subject. The first part is devoted mainly to Aqua Alexandriana, which Fabretti practically rediscovered; the second deals with the springs of Aquae Marcia and Claudia; and the third criticizes the discrepancy between the statement of Procopius that Rome was supplied by fourteen aqueducts, and the information of the *Notitia*, the *Curiosum*, and the interpolation ascribed to Publius Victor,⁵ which brings the number up to nineteen or twenty. The book is full of discursive information on topography, but Fabretti had not intended it to be his last word on the subject: he mentions a detailed description of the course of the aqueducts which he had in mind.⁶ A second edition, with useful notes, was issued in 1788 by Natale Barbiellini,⁷ who, in the dedication to Pius VI, observes that the original was rare, but does not say who wrote the notes.⁸

Other surviving topographical works by Fabretti are of less value. He had⁹ severely criticized Gronovius on the Algidus and territory of Tusculum;¹⁰ and in 1685 Gronovius briefly replied,¹¹

¹ Bound together in one volume with an inventory compiled by me, *Barb. Lat.* 9898.

² *Königliche Bibliothek, Cod. F.* 193 (see *Röm. Mitt.*, 1908, 295).

³ Carini, *L'Arcadia dal 1690 al 1890*, i. 53-9.

⁴ *Raph. Fabretti Gasparis f(ilius) Urbinatis de Aquis et Aquaeductibus veteris Romae dissertationes tres; Romae, Typis Ioannis Baptistae Bussotti, MDCLXXX.* Diss. I, 31 December 1677, dedicated to Giovanni Lucio of Trau, once (*Inscriptiones antiquae*, preface) mathematical tutor to Fabretti's nephew, and author of works on Trau and Dalmatia (*obiit. c.* 1695, Fabretti, *Columna Traiana*, 7). Ciampini (*Vetera monumenta*, preface) speaks warmly of Lucio and of collaborative studies in ancient mosaics, and quotes him (p. 34) for archaeological information. Diss. II, 12 August 1679, dedicated to Gaspare Carpegna, who made, as Cardinal-Vicar of Rome (1670-1714), a collection of antiques, of which Fabretti was curator for three years (*Inscriptiones antiquae*, preface), and which he intended for the Vatican Library. It went to Paris under Napoleon, and was incorporated in the Cabinet des Médailles (*Documenti inediti per servire alla storia dei musei d'Italia*, ii, pp. x-xii, 182-224). Diss. III, 27 October 1679, dedicated to Giulio dei Conti di Monteverchio, *scriptor in Graeca lingua* of the Vatican Library, and one of the learned friends of Ciampini (Fabretti alludes to C.'s house in *De aquis*, 36.: 30 as *academia experimentalis*). The first and third dissertations are dated from Fabretti's own museum, the second from Carpegna's library. The work was reprinted in Graevius, *Thesaurus antiquitatum romanarum*, iv, pp. 1677-1778, Leiden, 1694-9 and Venice, 1732.

⁵ For Publius Victor see Preller, *Regionen*, 38 ff.; Jordan, *Topographie*, ii. 291 ff.; De Rossi, 'Note di topografia romana' in *Studi e documenti di storia e diritto*, iii (1882), 65 ff. Zabughin, *Pomponio Leto*, does not deal with the question.

⁶ 'Ut peculiari aliquando dissertatione, de itinere aquarum, fusius prosequar', pp. 154: 147.

⁷ *Éditio secunda Romana adnotationibus illustrata.* I have cited the paging of both.

⁸ It was not Ridolfino Venuti; see p. 48, *a* and p. 155, *a* of this edition.

⁹ 183: 177.

¹⁰ *Jacobi Gronovii epistolae in quibus multa Titi Livii loca geographica emendantur*, Amsterdam, 1678.

¹¹ *Jacobi Gronovii Responsio ad Cavillationes Raphaelis Fabretti*, Leiden, 1685.

moving Fabretti to counter-reply angrily in a work¹ entitled *Iasitheii ad Grunnovium Apologema, in eiusque Titilivitia sive somnia de Tito Livio Animadversiones, Neapoli, apud Novellum de Bonis, 1686*. This contains little topographical information. More was doubtless ready for a large work which he contemplated on the Campagna,² illustrated with maps,³ but old age prevented its compilation.⁴ A few interesting remarks of his occur in a letter-dissertation entitled *Sopra alcune correzioni del Lazio del P. Atanasio Kircher*,⁵ dated from Pesaro on 3 April 1672, but only published in 1741.⁶

Fabretti's knowledge of the aqueducts themselves is somewhat unequal.⁷ In the upper valley of the Anio he clearly worked only from Via Valeria; as indeed Lanciani did, for bridges over the Anio were rare until recently. Apart from details about the springs, he adds nothing new. He appears to have seen the Ponte Arconi,⁸ which he identifies with the *Arcus de Ferrata in Territorio Ruviano* of the medieval documents; he notes the fragments of *specus*⁹ in the cellar of the Osteria della Ferrata and near the Osteria della Spiaggia; and he must also have caught sight of the Anio Novus¹⁰ near the Molino del Raio, from the opposite bank. He saw a *specus*¹¹ above Via Valeria, and he perceived that the bridge¹² at Vicovaro was built on an ancient aqueduct. But further down-

¹ 'Raphaelis Fabretti Gasparis f(ili) Urbinate ad Jacobum Gronovium Apologema in eiusque Titilivitia sive somnia de Tito Livio Animadversiones antea edita sub nomine Iasitheii. Anno MDCLXXXVI. Superiorum Permissu' is another version in which the title-page was changed, though page-headings remained the same, and my copy bears Fabretti's name, with the printer's name only at the end. Possibly Fabretti had a first edition printed at Leiden, as he addresses his reply to the Moderators of the University there.

² pp. 55 : 45 (after speaking of the Via Aurelia) *sed haec plenius in nostro De Agro Suburbano opere omnino enucleabimus*, ib. 182; *afferam hic, e meis ad opus quod meditor de Agro Suburbano adversariis, exemplar sequentis lapidis* (CIL. xiv. 2770).

³ One of them is to be found in *Iasitheii Apologema*, opp. p. 99. 'Utque iam deprehendas, Lector, ex eburnea porta sua somnia Grunnovio transmissa fuisse, rectam horum locorum faciem contemplare, quam ex ampliori Tabula nostri Agri Suburbani huc transtulimus.' This map appears opposite p. 90 of the second edition of the *De aquis* (cf. *Inscriptiones*, p. 415, col. i sub fin).

⁴ *Inscriptiones*, p. 793 fin. In *De aquis* (2nd ed.), p. 45, note a, it is noted that no manuscripts relating to it could be found.

⁵ Kircher's inaccuracies in regard to the representation of the aqueducts in his maps are flagrant: and his text is equally full of errors (e.g. his p. 31).

⁶ *Saggi di dissertazioni dell' accad. etrusca di Cortona*, vol. iii, pp. 221 ff. Ridolfino Venuti, Secretary to the Academy, notes that it had been found among unpublished papers (ibid., p. xviii).

⁷ It is worth note in passing that Marco Antonio Boldetti, author of a work on the catacombs, Caetano Ridolfi, and Giovanni Marangoni, who wrote on the Colosseum and on ancient marbles used for the adornment of churches, penetrated into the innermost recesses of the *specus* of the Aqua Marcia at S. Cosimato in 1714, though none of them has left any record of what he saw there (see below, p. 103).

⁸ 67 : 59, Diss. II, tab. i. 10. He explains it (80-71) as *aquaeductum qui Anienem sub Ruviano transmittit conspicitur, infra*, p. 258, n. 3.

⁹ Diss. II, tab. i. 9.

¹⁰ *aquaeductus ad latus boreale montis sub Saracinesco*, ibid., 8, see p. 260.

¹¹ Ibid., 7, *veteris alterius Aquaeductus, e proximis a Septentrionali latere collibus derivati*,

vestigia: infra, p. 99.

¹² Ibid., 6.

stream everything escaped him until near Tivoli, where he saw the remains in Val d'Empiglione, and seems to have followed that valley as far as Ciciliano, where he observed ruins,¹ which he wrongly calls Saxula. At Carciano he notes only the existence of three *specus*² near the Madonna di Carciano.

The next scholar to devote attention to the aqueducts, though publishing even less than Fabretti, was Diego Revillas,³ a Spaniard, Abbot of the Order of S. Jerome, Professor of Mathematics at the University of Rome from 1725 onwards, and a Fellow of the Royal Society⁴ of London. Some of his papers are in the Vatican Library.⁵ Others were obtained by Costantino Corvisieri from the Keeper of archives at S. Alessio, where Revillas lived in Rome. Corvisieri sold part of these to the Berlin library in 1873,⁶ keeping the rest himself; and this latter part was bought by the author at the sale of his library, and is now in the library of the British School at Rome. The matter contained in both portions is often identical.

Among the British School manuscripts are considerable portions of a work which Revillas hoped to publish with English help. Fragmentary drafts of a letter to a patron show that there were to be four dissertations⁷ in one folio volume, the first on *Viae Tiburtina*, *Valeria*, and *Sublacensis*, preceded by a note on the Roman mile and foot; the second on *Aquae Anio Vetus*, *Anio Novus*, *Marcia* and *Claudia*; the third on the territory of Tivoli and its ancient remains; the fourth on the Marsi, the Fucine Lake and its *emissarium*. He predicted that the work would be ready for press early in 1739, and mentions encouragement from Sir Smart Lethieullier, the scholar and antiquary, and Sir Charles Frederick,⁸ a prominent collector, who was in touch with the fourth Earl of Carlisle.

One map⁹ intended for this work and showing the territory of

¹ Diss. II, tab. i. 5.

² Ibid., 4.

³ See *PBSR*. iii. 198, from which this account is taken, with additions and corrections.

⁴ He contributed eight papers, mostly on astronomical and meteorological subjects, to the *Philosophical Transactions of the Royal Society*, vols. xxxix–xlii.

⁵ *Vat. Lat.* 9024, 5 ff.

⁶ *CIL*. vi, p. lxiii, no. cii.

⁷ Cf. his programme in *Novelle letterarie*, i (1740), 8–9, perhaps written after hope of English patronage had been abandoned.

⁸ He had a collection of antiques, which was sold in 1786, Towneley being one of the purchasers. See Michaelis, *Ancient Marbles in Great Britain*, § 36, p. 61. The Carlisle connexion emerges from a letter in the author's possession.

⁹ It measures 430 × 665 mm. Below is the engraver's name: *Io(an)es Bap(tis)ta Sinte's sculp(sit) Romae super(iorum) p(er)m(iss)u*. Scattered about it are a number of inscriptions and four vignettes (tab. i–iv) of which tab. ii represents the interior of the chapel of S. Vincenzo near the Fucine Lake. Not having then seen a copy of this map, I reproduced tab. ii as a ruin at Carsoli on pl. xvi of *Suppl. Papers American School*, i (cf. p. 113, n. 1, where part of the text of Revillas's work relating to Carsoli is given, and p. 126, n. 1). Revillas states that a copy of the map had already been sent to his patron through Thomas Denham.

the Marsi had been published in 1735. It bears the following dedication, in a tablet on the left: *Marsorum Diocesim | primum Trigonometrice Delineatam Et Veteribus quae in Ea extant | Monumentis | Vel Ineditis, vel Emendatis adornatum | Illustrissimo ac Reverendissimo Domino | D. Josepho Baroni | Vigilantissimo Mar-sorum Episcopo Didacus De Revillas Abbas Hieronymianus In Rom(ano) Sap(ientiae) Archigym(nasio) Pub(licus) Matheseos Prof(essor) Regiae Londinensis Societatis Et Accad(emiae) Instituti Scientiarum Bononien(sis) Sodalit Obsequii et Amicitiae tesseram d(edit) d(onavit) d(edicavit) A.D. MDCCXXXV.*

A second map was published by Revillas, in 1739, as a separate sheet. This showed the Diocese of Tivoli, and was entitled¹ *Diocesis et Agri Tiburtini Topographia, nunc primum trigonometrice delineata et veteribus viis, villis ceterisque antiquis monumentis adornata.* This provides no new information on the aqueducts, but is an interesting summary of knowledge then available, while the small map of the neighbourhood of Tivoli (*Tiburis suburbia*) is especially useful. Numbers are attached to inscriptions in the foreground showing that a text was intended, and there is a long legend (*Notarum explicatio*) in the upper right-hand corner.² To this edition a letter of Canina to Coppi³ refers, in which he states that during a visit to Tivoli he found, in the episcopal library, the original plate of this map, and had a special edition of fifty copies printed from it, meanwhile, in 1885; to these the words *Sumptibus Episcopi Tiburtini* have been added. Before 1767, Petroski⁴ had engraved a new plate, which exactly copied the first,⁵ with one important addition—a small plan of Horace's Sabine farm (*Villae*

¹ Measuring 440 × 680 mm. The dedication is in a tablet at the left on the top. Two Egyptian figures from Hadrian's Villa now in the Vatican Museum serve as supporters, and above is a vase. At the bottom, on the right, is the engraver's name, *Io(an)nes Petroschi Inc(idit)*. The first edition bears, in a label on the right near the bottom, the following; *Cil(arissimo) V(iro) Fr. Joachimo Portocarrero Amplissimo Patriarchae Antiocheno Did(acus) Revillas D(idaci) f(ilius) Abbas Hieronym(ianus) Rom(ani) Archigymnasii P(ublicus) Mathes(eos) Pr(ofessor) Regiae Londin(ensis) Societ(at)is Accad(emiae) Scient(iarum) Instit(uti) Bon(oniensis) et Regiae Accad(emiae) [sic] Pelorit(anae) Sodalit Aet(ernus) Devot(issimus) Monum(entum) d(onavit) d(edicavit) A. MDCCXXXIX.* The patron, Monsignor Gioachino Fernandez Portocarrero, Count of Palma, Marquis of Almenara, Bailo of the Order of St. John of Jerusalem, Patriarch of Antioch, &c., was Lucumo, or President, of the Etruscan Academy of Cortona in 1740, and to him is dedicated the third volume of the *Saggi di Dissertazioni* published in the following year. From the preface we gather that he had abandoned a military in favour of an ecclesiastical career.

² Part of it is reproduced in *Suppl. Pap. Amer. Acad. Rome*, i. 118, fig. 5.

³ Of 7 November 1885, see *PBSR*. iii. 198, n. 2. My own copy of the map is of Canina's edition.

⁴ His use of this form in the later edition shows that he cannot be identified with Petroschi, the notary of Vicovaro, whose discovery in 1757 of the inscription which mentions the *Massa Mandelana* (*CIL*. xiv. 3482) was, as De Sanctis pointed out, an important contribution to the discussion—a fact which I failed to realize before (cf. Lugli, *Mon. Lincei*, xxxi. 468, n. 3).

⁵ A careful examination will show that the plate is not the same.

Horatii Rudera) at the top right-hand corner, with three more inscriptions below it.¹ The *Notarum explicatio* has been considerably reduced in size so that this change could be made without suppressing any part of the map; and, above the label on the right, the arms of Portocarrero have been suppressed, while the label is empty. In 1767, the patronage of Cardinal Flavio Chigi was gained for a fourth edition. The Cardinal's hat and arms sufficiently filled the space above the label, in which was inserted the legend *Eminentissimo et Reverendissimo Principi D. Flavio, Diacono S. Mariae in Porticu S(anctae) R(omanae) E(cclesiae) Cardinali Chisio, Ioannes Petroski tabulam hanc a se aere incisam devotus nomini et amplitudini eius d(onat) d(icat) d(edicat) MDCCLXVII*. At the bottom was added a long legend about Horace's Sabine farm, and on the left the further notice *Presso l'autore passato Piazza di Spagna per andare ai Gregi, vicino la Speziaria di Burione* (now Farmacia Borioni, at 98 Via del Babuino). These additions brought the size of the plate up to 460 × 670 mm., this being a shade larger than the original, 440 × 680 mm.

Only two of Revillas's published articles appear to deal with archaeological subjects, and both were published by the Etruscan Academy of Cortona.² Then, as Cassio³ notes, death came to him also before his work was accomplished. Of unpublished works Venuti⁴ mentions a manuscript description of Tivoli by Revillas, 'che da i Letterati poco culti del presente secolo si è lasciato in abbandono e in noncuranza'. He also mentions⁵ a plan of Hadrian's Villa by Revillas, with another expected from Nolli,⁶ the author of the famous plan of Rome of 1746; but no trace of either has ever come to the author's notice. It must not be forgotten, however, that among the services of Revillas to posterity was the arrangement of the fragments of the Marble Plan of Rome in 1744, as Hülsen has noted.⁷ At the beginning of his manuscript describing the excavations of the Naumachia Vaticana,⁸ Revillas

¹ CIL. xiv. 3482, 3485; 382; from Volpi, *Vetus Latium*, x. 2, 146, cf. p. 360, n. 2.

² *Saggi di Dissertazioni Accademiche pubblicamente lette nell'Accademia Etrusca di Cortona*, vol. i, part ii (1742), 65–92, Dissertazione II, del P. Abate de Diego Revillas, lettore di Matematica nella Sapienza di Roma, Membro della Regia Società d'Inghilterra, dell'Accademia dell'Istituto delle Scienze di Bologna, e della Regia Accademia Peloritana di Messina. Also *Sopra la Colonna degli Antichi chiamata Milliarium Aureum*, vol. iii (1741), 111–39, Dissertazione IV, *Sopra l'antico piede romano, e sopra alcuni Stromenti scolpiti in antico Marmo sepolcrale*. The MSS. at the British School include a longer version of the latter, dedicated to Sir Charles Frederick and to Sir Smart Lethieullier.

³ *Corso dell'Acque antiche*, i, p. xi, par. 44. The date was 22 August, 1746.

⁴ In the second edition of Eschinardi's *Descrizione di Roma e dell'Agro Romano* (1750), 241.

⁵ *Ibid.*, p. 242.
⁶ Revillas may have been the author of the notes for Nolli's plan published by De Rossi, in *Studi e documenti di storia e diritto*, v (1884); De Rossi (p. 81 of reprint) did not think they could be his, while Schreiber in *Sächsische Sitzungsberichte*, 1892, 116, (quoted *Fahrh. d. Inst.* (1913), 235, n. 2) merely says that he thinks he has grounds for the attribution.

⁷ *Diss. acc. pont. arch.* 2, viii. 365.

⁸ Published by Canina, *ibid.* i. x. 455 ff.

speaks of these fragments, 'now ordered by your Holiness, with the universal approval of scholars, to be placed in the Capitol', and says that 'your Holiness had deigned to order me, and Marchese Capponi, to attend to the arrangement and collocation of the fragments aforesaid'. Count G. Menatti¹ of Milan, one of the Conservators, mentions 'the placing of the ancient plan of Rome on the stairs of the Museo Capitolino, by the diligent labours of the most learned Father Abbot Revillas, my fellow-citizen'.

The next work was Cassio's, which was finished nine years after Revillas's death, and bears the title *Corso dell'Acque antiche*, Rome, 1756-7. The portrait and *approbatio* are dated 1755, while the inscription round the portrait-frame shows that Cassio was born in 1669; thus, Giuseppe Bianchini, one of the two censors, rightly remarks² 'plerique scriptores sub finem defatigati, minus accurate properant; ipse contra, licet supra octuagesimum annum agens, diligentius contendit quanto maius a principio.'

The work as a whole is uncritical and confused, if it contains some original information. His maps are not good, and decidedly inferior in execution to those of Cingolani and Ameti, of which he made use.³ Nevertheless, he was among the first to describe the remains, on the left bank of the Anio, of what he believed to be the Marcia, after it had crossed the Anio at S. Cosimato, saying⁴ 'Sopra un po' d'opra Arcuata trapassava il Torrente, o Fosso Vallana, in distanza di $\frac{1}{2}$ miglio [from Saccomuro]. Dopo ii si avvicinava alla Mola di Castello Apollonio, oggi Madama, nella Vigna de' Livii, dove un di lei lungo arcuato; e nella valle di contro ammiransi i grossi Archi della Claudia e dell'Aniene.'⁵ But confusion pervades his account⁶ of Aqua Claudia: 'raccolti in uno li iv nominati Fonti, introdotti nel preparato speco col nome specifico d'Acqua Claudia, dava principio al suo corso valicando l'Aniene dopo iii miglia sopra un Ponte, che Fabretti nella sua Tavola dice Acquidotto sotto Roviano ed erroneamente nella Revillana vi si dà il passo alla Marcia, siccome altrove addittassimo. Dal Ponte con ii e $\frac{1}{2}$ perveniva alle sustruzioni che appariscono

¹ *Spiegazione di un bassorilievo rappresentante il feroce Curzio Sabino*, Rome, 1744, p. 15.

² p. xlvii.

³ Vol. i, preface, p. xi, par. 46. 'Scielsi per guida le carte topografiche dell'agro romano Cingolana, illustrata dal P. Eschinardi della Compagnia, quelle del Lazio formate già dall'Ameti, delle quali dichiarossi essersi pure valsuto il celebre Sig. Poleni nelle sue note a Frontino, come forse le più esatte sinadora pubblicate; sebbene il dotto P. Meher, Rettore in Roma del Collegio Inglese, che stende la Tavola del Tuscolo mi ha conferito, voler in alcuni siti correggerle.' This was Christopher Meyer, or Maire, the Jesuit, who worked with Boscovič on the survey of the Campagna and the fixing of a base on the Via Appia; the result being the *Nuova carta dello Stato Ecclesiastico* published about 1750, and dedicated to Benedict XIV.

⁴ i. 104.

⁵ Cf. i. 153, 161, where he mentions the Claudia and Anio Novus in the Fosso Vallana, and the Anio Novus in the Vigna de' Livii.

⁶ i. 153.

appiè di castello Saracinesco;¹ con i alla Foresta passato il Rivo Giovenzano di contro al Convento di S. Cosimato; con iv arrivava alle sostruzioni triplicate sopra al Torrente Vallana, le quali asportavano le tre Acque, Claudia, Marcia ed Aniene, ciascuna nel separato suo speco, e dopo iii altre giungeva nella Valle dell'antico Ampilione, al presente di castel Madama, sotto al sito delle Fontanelle in poca distanza dal fosso degli Arci o della vigna del Seminario di Tivoli.' On the other hand, he is accurate on the Anio Novus;² and his account of the portion of both the Anio Novus and the Claudia between Gallicano and Capannelle is surprisingly good, for he does not speak as if he had seen much, if anything, in the way of actual remains. After the publication of his work methodical study of the course of the aqueducts lapsed for about a century.

Dodwell and Vespignani, in a series of illustrations, now preserved in the Soane Museum, for an abortive work on the various styles of construction in Italy, took some slight account of the aqueducts. The first volume, actually prepared for publication, consists entirely of plates by Vespignani alone; the second and third volumes contain preliminary sketches, some by Vespignani and some by Dodwell.³

Nibby, one of the greatest explorers of the Campagna, was not generally interested in the aqueducts, though he spent much time and labour in examining special problems.⁴ Canina also devoted to the bridges a number of plates in his *Edifici Antichi*,⁵ most welcome as the first architectural drawings of them that we have; yet their value is less considerable than is generally believed, and the accompanying text is not of great merit. It would, in fact, have required more detailed study to define the many restorations which they underwent; and to this the circumstances of travel at that time did not lend themselves. Parker's historical photographs, the negatives of which were destroyed by fire in Rome some fifty years ago, included a number of important illustrations of the aqueducts.⁶ His volume on the *Aqueducts of Rome* contains some

¹ These really belonged to the Anio Novus, see p. 260.

² i. 160.

³ *Röm. Mitt.* xxiv (1909), p. 3. A list of those which relate to the aqueducts is given here. While interesting, they have no great importance, inasmuch as all that they show is still in existence. Vol. i, pl. cviii; 4, Ponte S. Pietro, ashlar = iii. 26 (Vespignani), iii. 28 (Dodwell); 5, Ponte S. Gregorio, *opus mixtum*; 6-9, Details of construction and *specus* = iii. 22 (Dodwell); 10, 11, Details of bridge of Aqua Claudia over Fosso Vallana = iii. 23-5 (Vespignani). Pl. cix: 1, Ponte Lupo, *opus quadratum* on upper level = iii. 30 (Dodwell); 2-3, *Ditto*, other details of ashlar = iii. 31 (Dodwell); 1-3 = iii. 27, 32 (Vespignani); 4, Ponte S. Antonio, ashlar, detail = iii. 26 (Vespignani), 29 (Dodwell).

⁴ Cf. *infra*, pp. 185-7, 220, 303. His criticisms appear in the work *Analisi della carta dei dintorni di Roma*, Rome, 1837, henceforward quoted as *Analisi*.

⁵ Vol. iv, pls. 223-31 (223=238); vol. vi, pls. 74, 75, 77 (= iv, 231, fig. 8), 139, 147.

⁶ Complete collections of prints exist in the Bodleian Library at Oxford, and in the Libraries of Harvard University and of the University of Michigan at Ann Arbor; while

reproductions of these, and reprints the section¹ of his *Catalogue of Historical Photographs* dealing with the aqueducts.

Finally, in 1880, Lanciani published his great work, *I commentarii di Frontino*, to which reference has already been made in the preface.² This was the starting-point of modern topographical work, and is the study of which this book, in that respect, claims to be a continuation.

the British and American Archaeological Society of Rome possesses a large part of them, now on permanent loan at the British School.

¹ pp. 114 *bis*, ff.

² *Supra*, pp. xi-xii.

I. THE MAKING AND PRESERVATION OF THE AQUEDUCTS IN ROMAN TIMES

THE aqueducts of Rome were especially famous in antiquity. Strabo¹ classes them, with the roads and drainage-system, as the most remarkable of the City's public works. The pure water which they conveyed was equally renowned. Galen,² the doctor, notes that 'the beauty and number of Rome's fountains is wonderful. None emits water that is foul, mineralized, turbid, hard, or cold. . . . Those, however, which come from the mountains above Tibur in stone channels, though otherwise perfect, are certainly a little cold.' These references reflect the general opinion of antiquity; others, which are numerous, are given in the accounts of the aqueducts to which they refer.

Our knowledge of the history of the aqueducts depends principally upon the work of Frontinus, *curator aquarum* under Nerva and in the first years of Trajan, who wrote notes on their organization and administration. From this and other sources the following historical summary can be given.

The earliest aqueduct was the Appia, built in 312 B.C. by the censor Appius Claudius Caecus. Our knowledge about its course is very small, because it came into the City deep underground. It was followed, in 272–269 B.C., by the Anio Vetus, the first to draw its water and its name from the upper valley of the Anio. This was constructed by the censors, and only qualified as Vetus after the Anio Novus was built by the Emperor Claudius. Its supply must always have been larger than that from the Appia, to judge from the size of its *specus*, but we have no idea of the actual amount. The course of this also lay much below ground, for tactical reasons, according to Frontinus, who is probably right.

About ninety years later, the supply derived from these two aqueducts was clearly becoming insufficient. For Plutarch and Livy both note that Cato, as censor in 184–179 B.C., checked illegal access to the supply by cutting off pipes used for this purpose,³ Livy adding that the public basins were paved and that all the water allotted to private consumers was withdrawn.⁴ Accordingly, M. Aemilius Lepidus and M. Fulvius Nobilior, the censors of 179–174 B.C., let a contract for bringing a new supply and for

¹ Strabo, v. 3. 8, c. 235. οδοι προύνοησαν μάλιστα ὧν ἀλγύωρησαν ἐκείνοι, στρώσεως ὁδῶν καὶ ὑδάτων εἰσαγωγῆς καὶ ὑπονόμων τῶν δυναμένων ἐκκλύζειν τὰ λύματα τῆς πόλεως εἰς τὸν Τίβερυν.

² In Lib. vi. Hipp. de morbis vulg., vol. xvii. 2, p. 159, ed. Kell.

³ Plut., Cato Ma., 19; ἀποκόπτων μὲν ὀχετοὺς οἷς τὸ παραρρέον δημόσιον ὕδωρ ὑπολαμβάνοντες ὑπήγον εἰς οἰκίας ἰδίας καὶ κήπους. Cf. Frontinus, 7, cum . . . ductus . . . privatorum etiam fraudibus interciperentur alludes to the same practice; see also ibid., 97.

⁴ xxxix. 44.

constructing the necessary arches; but work was stopped by M. Licinius Crassus, who would not allow the aqueduct to be taken across his property.¹ There is thus no doubt that a new aqueduct was projected, though its source is unknown.

Actually, the supply was not increased for yet another thirty years, when Q. Marcius Rex, praetor in 144 B.C., was empowered by the Senate to restore the existing aqueducts, and to construct a new one, which came to bear his name. For the new supply he tapped the excellent and abundant springs in the upper valley of the Anio, which, after centuries of neglect, were brought again to Rome in 1870 by the modern Acqua Marcia. His praetorship was extended for a second year to enable him to complete the work; and, in defiance of a prohibition in the Sibylline Books, he brought the Marcia and the Anio Vetus to the Capitol, where a statue was erected in his honour.

The fourth aqueduct, constructed once more by censors in 125 B.C., was the unimportant Aqua Tepula, supplied from the Alban Hills. Nearly a century passed before another supply was added. Then Agrippa, as praetor,² in 40 B.C. drew from the same district the Aqua Iulia, and, seven years later, repaired Aquae Marcia, Appia, and Anio Vetus. In 19 B.C., he built the Aqua Virgo, which tapped extremely good springs not far from Rome and came into use again during the sixteenth century. This supplied his *Thermae*, and thereafter, as noted by Lanciani, constructors of similar Baths, which consumed much water, usually compensated for the loss to the general supply by adding a new aqueduct or increasing the capacity of an old one. After Agrippa's death in 12 B.C., the aqueducts became an Imperial charge, and their Republican administration may now be summarized.

According to Frontinus,³ the maintenance of the aqueducts was let out by the censors to contractors, who had to employ a fixed staff of slaves in and beyond the City, entering in public records the names of those employed for each region. Their work was inspected by the censors, aediles acting during a vacancy. Frontinus⁴ also quotes cases of inspection by quaestors, but these, as Hirschfeld⁵ thought, are probably exceptional, since censors and aediles had entire charge

¹ *Livy*, xl. 51. 7. 'Locarunt aquam adducendam fornicesque faciendos. Impedimento operi fuit M. Licinius Crassus, qui per fundum suum duci non est passus.' Gilbert, *Topogr.* iii. 266, n. 3, is wrong in referring this passage to an increase in the supply brought by the two aqueducts already existing. The position of Crassus' property is unknown.

² So Dio, xlviii. 32. 3 as against Pliny and Frontinus. There is considerable confusion about the dating of Agrippa's work. See individual account below, p. 161.

³ *Frontinus*, 95-6.

⁴ *Frontinus*, 96, bases his statement that quaestors took the office on a *senatus consultum* of uncertain date.

⁵ *Die kaiserlichen Verwaltungsbeamten* 2, 274. *CIL*. i². 743=vi. 31590 has been recently re-examined and undoubtedly refers to the *curatores viarum e lege Visellia*.

of the distribution of water and of grants to private individuals, which were rare and usually for commercial purposes. On this view, Cicero's reference to Vatinius' *provincia aquaria*¹ must be taken as a sarcasm; and Mommsen's idea,² that under the late Republic a quaestor may actually have been in charge of the aqueducts, must be discounted. The administration was not conducted without scandals, as is implied by the speech of Rufus, *De aquis*.³

The formal revision of this system came in 11 B.C., after the death of Agrippa, who had been, as Frontinus observes,⁴ 'a life-curator of his own public works'. Agrippa had bequeathed his staff of two hundred and forty skilled slave-workmen to Augustus, who handed it over to the State, as the nucleus of a new *familia publica*.⁵ The Senate, carrying out the new organization in its own name, gave the nomination of the new officials to Augustus and defined their powers in a series of *consulta*, of 11 B.C. These are recorded by Frontinus in full,⁶ as the basis of his authority.

The new curatorship was the most distinguished of its kind, and several holders⁷ passed direct from it to the crown of a senatorial career, the proconsulship of Africa. The power held was the old censorial power. The technical part of the work, which had been laid down by Agrippa in *commentarii*,⁸ was entrusted to technical assistants, and is dealt with elsewhere. The most important duty was the maintenance of the system, paid for by Augustus.⁹ The prevention of damage was provided for by a special law¹⁰ of 9 B.C. Then came the control of private customers; the exclusion of unauthorized consumers; the regulation of the permanent staff; the contracting of work which the permanent staff could not carry out; and the judging of cases of damage or encroachment on the water-board's land. This administrative and legal business was estimated to take three months, and the *curatores* were to allow this time for it, as in other branches of the Administration. The public supplies were fixed at Agrippa's standard. Grants to new consumers remained in the Emperor's control.

Augustus followed his reorganization by increasing, in 11-4 B.C.,

¹ *In Vatini*, 5. 12.

² *Staatsrecht*, ii. 2. 573. He admits that it is impossible to see the relation of this *provincia* to the regular functions of the aediles and censors.

³ *Frontinus*, 76. *Cic. Ep. ad Fam.* Nisi ego cum . . . *aquariis pugnarem*, viii. 6, 4.

⁴ *Frontinus*, 98, *operum suorum et munerum velut perpetuus curator fuit*.

⁵ *Ibid.*

⁶ *Ibid.*, 100-1, 104, 106, 108, 125, 127.

⁷ e.g. Calpurnius Piso, Vibius Crispus, and Funisulanus Vettonianus.

⁸ *Qui iam copia permittente discipulis, quid aquarum publicis operibus, quid lacibus, quid privatis daretur.* *Frontinus*, 98. *Lanciani*, 350 : 562, considers that Agrippa had made plans showing the way in which the water was distributed to its various users. The word *discipulis* will hardly bear this sense, though the thing is probable enough in itself. A fragment of such a plan on a marble slab of the time of Augustus, found on the Aventine (*CIL*. vi. 1261), belongs to the Aqua Crabra, see below, p. 46, n. 6.

⁹ *Frontinus*, 125, *se refecturum impensa sua*.

¹⁰ *Ibid.*, 129.

the springs at the sources of the older Aquae Appia and Marcia, letting new springs, named after him, into their channels. He built a new branch, the *specus Octavianus*, on the Anio Vetus. As already noted, he repaired the aqueducts as a whole, marking their course with boundary-stones (*cippi*) which remained in use till the latest times.¹ Later in his reign, he brought in yet another aqueduct, the Alsietina, also called Augusta, to supply his *Naumachia*, built in 2 B.C. on the right bank of the Tiber; this was the lowest of all in level and its water was very inferior.

Tiberius limited himself to providing *cippi* in A.D. 36–7 for the Aqua Virgo, probably restoring it at the same moment. Gaius, in A.D. 38, began to lay out two more aqueducts from the Anio Valley, both finally completed by Claudius in A.D. 52, when one took Claudius' name. The first was supplied from the springs which fed the Aqua Marcia; while the second, called Anio Novus to distinguish it from the older Anio aqueduct of 272 B.C., now styled the Anio Vetus, took its water from the river. Meanwhile, Gaius disturbed Aqua Virgo in connexion with building schemes in the Campus Martius. In A.D. 44–5 Claudius repaired the Aqua Virgo, providing it with new *cippi*. The Anio Novus appears to have had *cippi* also, though all known examples are uninscribed.

It has been considered² possible that Claudius prepared for the acquisition of the necessary land by at least one large confiscation, that of the gardens of Statilius Taurus in A.D. 53. Roman law did not permit expropriation for public works. Carcopino, therefore, thinks that this penalty bore the same relation to the construction of Porta Maggiore, the great Archway of Aquae Claudia and Anio Novus, as the forced suicide of Torquatus³ in A.D. 64 and the sequestration of his estates seem to bear to the construction of the *Arcus Neroniani*. This idea is ingenious but open to question; for the inscription on Porta Maggiore cannot be later⁴ than 24 January A.D. 53, while Taurus' death only occurred in that year, and not necessarily so early in it. More exact information about the date of Taurus' condemnation is therefore required before the theory can be accepted.⁵ The *Arcus Neroniani*, on the other hand, definitely post-date the death of Torquatus; and there seems

¹ Of early aqueducts only Aqua Virgo has *cippi* later than Augustus, while of Aqua Appia no *cippus* has been found.

² J. Carcopino, *Basilique pythagoricienne*, 72 (cf. *infra*, p. 49).

³ Tac., *A.* xv. 35.

⁴ Carcopino (op. cit. 18) thinks the dedication may have been on Claudius' birthday, 1 April A.D. 52.

⁵ It may also be added that the surveying of the course and arrangements with proprietors must have been carried out years before, by the engineers of Gaius. The need to confiscate thus belongs to the preliminary, not the final, stage: cf. the action of Crassus, cited above (p. 11). Again, if the Claudia was ready by A.D. 47 (see below, p. 191) the very construction of the Porta Maggiore must have antedated the confiscation by at least five years. ED.

no reason why the *horti Torquatiani* of which Frontinus speaks, should not be the confiscated estate, retaining its name as did so many gardens. But to prove that the aqueduct supplied the motive for the confiscation requires further evidence.

Nero did not increase the general supply, but redistributed it, erecting the arches that bore his name and served the Palatine, Caelian, and Aventine. This reorganization¹ was attended by measures to prevent appropriation of water by private persons, notably in order to conserve the supply for fire-fighting. Special conservators were appointed: but the abuse had grown up afresh by the end of the century, and gave Frontinus much to do.

Vespasian and Titus also confined themselves to repairs; and those of Titus were extensive,² to judge from actual remains. Actual remains, on the other hand, shed no light on the work of Paquedius Festus³ under Domitian, who states that he worked on the Aqua Claudia below Monte Affliano. Trajan⁴ presently built a new aqueduct in A.D. 109 on the right bank of the Tiber, to serve the industrial quarter. In his reign falls the curatorship of Frontinus, who carried out, by his own account, a thorough revision of the whole system.

There are considerable traces of activity by both Hadrian and Septimius Severus along the four aqueducts from the Anio Valley. But neither epigraphy nor literature mentions work by the former, and only a fragmentary inscription⁵ of A.D. 196 vouches for repairs to the Aqua Marcia by the latter. Still further repairs were needed under Caracalla,⁶ in A.D. 212-13, and he also brought in a new spring, the Fons Antoninianus, no doubt to compensate for the supply absorbed by his Baths. Similarly, Alexander Severus,⁷ who rebuilt the *Thermae* of Nero, built a new aqueduct to bring water from springs on the north slopes of the Alban Hills, a source re-used by Sixtus V at the end of the sixteenth century. Restorations and additions to the Aqua Marcia by Diocletian, also the builder of enormous *Thermae*, are attested by the name⁸ '*forma Iovia*', and by actual work. Constantine restored the Aqua Virgo with the Baths of Agrippa.⁹

In the Regionary Catalogue, which is an appendix to the *Notitia* but dates from the period of Constantine, more aqueducts than the thirteen here mentioned are enumerated. Their number runs to nineteen, as also in the catalogue of Polemius Silvius.¹⁰ It seems unnecessary to give details of these here. The catalogues also

¹ *Frontinus*, 20; Tac., *A.* xv. 43. 4.

² *CIL.* vi. 1246, 1257, 1258, see pp. 90, 192 and index, s.vv. Titus and Flavian.

³ *Infra*, p. 209. *CIL.* xiv. 3560.

⁵ *CIL.* vi. 1247, see p. 91.

⁷ *Hist. Aug. Alex. Sev.* 25, see p. 308 n. 1.

⁹ *CIL.* vi. 31564.

⁴ *CIL.* vi. 1260, see p. 299.

⁶ *CIL.* vi. 1245, see p. 91.

⁸ Discussed, pp. 91-2.

¹⁰ *Chron. Min.* i. 545; see Jordan, *Top.* ii. 223.

give the number of fountain-basins (*lacus*) in each ward of the City, and, as Lanciani pointed out, this is more than twice that given by Frontinus, who arranges them by the aqueducts which supplied them. This discrepancy may perhaps be reconciled by including the *munera* of Frontinus in the total of *lacus* for each region; for these elaborately decorated fountains are not otherwise mentioned in the Regionary Catalogues.

After Constantine there is no record of work on the aqueducts until the Anio Novus was repaired¹ by Gratian and Valentinian II in A.D. 381. The springs of the Marcia were protected² under Arcadius and Honorius in A.D. 398–9 from the encroachments of the Anio; while, in A.D. 402, a Constitution³ threatened heavy penalties for damage to the Claudia. Ordinarily it would look as if, in the late period at least, owners of estates through which the aqueducts passed had to contribute to their upkeep; for, in A.D. 471 Flavius Valila, also styled Theodovius, gave property to a Tivoli church on this condition.⁴

Procopius,⁵ writing of conditions in the early sixth century, states that Rome had fourteen aqueducts. But no new aqueduct had been constructed between the time of Alexander Severus and his own day. To arrive at the total of fourteen we have to add in three branches, the Augusta (Appia), the Specus Octavianus (Anio Vetus), and the Specus Antoninianus (Marcia). Again, Fabretti⁶ and Lanciani⁷ have pointed out that Procopius exaggerates in saying that 'their channels are so broad and deep that a horseman could ride through them'.

But the same author is of value in dealing with their vicissitudes during the Gothic War. In the Gothic siege of 537 Vitigis hastened to put the aqueducts out of action by cutting their channels, while Belisarius blocked their continuation into the City, lest they should serve the foe as an entry.⁸ When the danger was over, repairs were carried out. There is a definite record that Belisarius rebuilt the Aqua Traiana;⁹ while the late *opus mixtum*¹⁰ visible in the Aqua Marcia near the Osteria della Spiaggia, and in the same aqueduct

¹ CIL. vi. 31945, see p. 253.

² CIL. ix. 4051, see p. 92.

³ Cod. Theod. xv. 2, 8.

⁴ See Bruzza, *Regesto della chiesa di Tivoli*, I, 'ut non solum (*solum*) solempnem modo agnoscat fiscalium functionem, verum etiam propagatione (pro purgatione?) formarum peracti (quod perinde?) ab omnibus domini(s) huiusmodi prediorum dependi consuevit'. From a passage further on in the document, we gather that such estates were called *praedia forme(n)sia*. Valila was responsible for the building of S. Andrea Cata Barbara Patricia: see *Rivista d'archeologia cristiana*, 1932, 221–55; also *Lib. Pont.* xlviii. i. ⁵ BG. i. 19. 13.

⁶ *De Aquis*, 152 : 145.

⁷ Lanciani 186 : 398; cf. *Destruction of Ancient Rome*, 79.

⁸ Procop., BG. i. 19. 13 & 18. An attempt to enter the City by the channel of the Aqua Virgo is described in BG. ii. 9, 1–11 (*infra*, 169).

⁹ CIL. xi. 3298, see p. 302.

¹⁰ See pp. 99, 137, 240. There were also extensive repairs in this style to Aqua Alexandriana, see pp. 310, 312, 313.

and the Aqua Claudia in the Vicolo del Mandrione (Pl. XIV) is very like the repair-work attributed to him on the City Wall.

Various Popes, from the seventh to the ninth century, undertook repairs to the Aqua Traiana in the interests of the water-supply for S. Peter's and for mills on the Janiculum. They also devoted much attention to the *Forma Lateranensis*, as the *Arcus Neroniani* were then called. But whether the latter aqueduct was still working at the close of the twelfth century is very doubtful; the Fons Virginum¹ near the Lateran, mentioned at that period, was probably supplied by the Marrana Mariana. The Aqua Virgo is mentioned up to the tenth century, but was not flowing beyond the Fontana di Trevi in its later days. The Aqua Alexandriana appears to be mentioned in A.D. 993, though not necessarily as still in use. The fate of the other aqueducts is even less definitely known, but it may be guessed that, from the ninth century onwards, their failure led to the gradual desertion of the hills in favour of the low ground near the Tiber, where water could be obtained from springs or wells or even from the river² itself. Thus, all the wells found within the area of the Forum belong to either the early Republican or the medieval period; that is, they precede or succeed the aqueducts. It seems improbable that large-scale repairs were undertaken after Belisarius. The still later work in Vicolo del Mandrione must represent a last attempt to keep the Anio Novus running, so that the *Forma Lateranensis*³ should not fail.

¹ Giraldus Cambrensis, *De Iure et Statu Menevensis Ecclesiae*, 577 (ed. Brewer, iii. 252): 'contigit autem his diebus papam (Innocent III, 1198-1216) ad Fontem Virginum . . . profectum esse. Erat autem fons ille fons pulcherrimus, a Laterano non longo intervallo meridionale et latere distans, limpidas et fulgidas aquas ex se fundens, Pariis lapidibus arte conclusus, et rivum amoenum et amplum ad campos emittens.'

² Cf. Giovannoni, *La tecnica della costruzione presso i Romani*, 115. The medieval Popes carried Tiber water with them on their travels, see *Lanciani*, 4: 216.

³ See p. 239, fig. 24, representing a moment when the task of supplying the city had been transferred from the Claudia, now blocked, to the Anio Novus; for the Claudia originally supplied the Forma Lateranensis (see p. 244). What is meant by the mention of the *aqua de forma Lateranens(e)* in connexion with S. Susanna (*Itin. Eins.* 2. 6), is obscure; see p. 153.

II. THE STAFF OF THE IMPERIAL WATER BOARD

THE little known about the Republican administration of the water-supply has already been mentioned. Under the Empire the acting board consisted of three *curatores*,¹ all of senatorial rank, comprising one *consularis*, acting as president, and two *adiutores*, or technical advisers, one at least a *praetorius*. There was no limit to the duration of the curatorships; the presidency² was held for periods varying from months to twenty-three years; of the *adiutores* too little is known to warrant a statement, as shown below.³

The personnel⁴ attached to the *curator* on his round outside the City included two lictors, three *servi publici* and one architect, together with the same number of *scribae*, *librarii*, *accensi*, and *praecones* as were allotted to a *praefectus frumenti dandi*. This staff⁵ was paid and fed from the *aerarium Saturni*, but the *curatores* often failed to use it;⁶ Frontinus himself did not employ lictors, relying upon his own authority to deal with obstruction.⁷ Stationery and instruments for the Department were initially provided by contract, entered into by the consul or consuls, in collaboration with the *praetores aerarii*.⁸ Renewals no doubt figured in the regular accounts.

(a) *Curatores*.

Many of the *curatores* are known, partly from the list compiled by Frontinus, and partly from inscriptions. Their careers⁹ are worth noting, since they indicate the standing of the office.

1. M. Valerius Messalla Corvinus: the distinguished lawyer,¹⁰ proscribed¹¹ by Antony in 43 B.C., allied with Brutus and Cassius, and fighting with them at Philippi.¹² After the battle he betook himself to Antony,¹³ whom he presently deserted for Octavian,¹⁴ and fought against Sextus Pompeius¹⁵ in 36 B.C. He accompanied Augustus against the Iapudians and Pannonians,¹⁶ and himself conquered¹⁷ the Salassi in 34 B.C. Antony's house was given to him and Agrippa;¹⁸ he was consul¹⁹ in 31 B.C., and held a command at Actium.²⁰ After this, he dealt with an Aquitanian revolt²¹ and

¹ Frontinus, 99. It has been assumed that the *adiutores* of c. 2 are the specific *adiutores* here assigned, but that is improbable; the word is being used generically for assistants, in laying down the general principle of relations between chief and staff.

² Cf. Corvinus and Turpilianus, below.

³ p. 23.

⁴ Frontinus, 100.

⁵ Ibid.

⁶ Ibid., 101.

⁷ Ibid.

⁸ Frontinus, 100.

⁹ There is little to add to *Prosopogr. I.R.* on which these accounts are based.

¹⁰ *Vell.* ii. 36; *Quintil.* x. i. 113; xii. 28; Tac., *A.* xi. 6.

¹¹ *Dio*, xlvii. 11.

¹² App., *B.C.* iv. 38; v. 13; Cic., *Ep.* i. 12, 15; Tac., *A.* iv. 34; Plut., *Brut.* 40, 41, 47, 75.

¹³ App., *B.C.* iv. 38. 136.

¹⁴ Plin., *N.H.* xxxiii. 50.

¹⁵ App., *B.C.* v. 102-3, 105, 109-10, 112-13.

¹⁶ *Tibull.*, iv. i. 108.

¹⁷ App., *Illyr.* 17; *Dio*, xlix. 38; *Strabo*, iv. 6, 7.

¹⁸ *Dio*, liii. 27.

¹⁹ Tac., *A.* xiii. 34.

²⁰ App., *B.C.* iv. 38.

²¹ *Tibull.*, i. 7, 3; ii. 1, 33.

was awarded a triumph¹ in 27 B.C. As *vir triumphalis*, he undertook to repair Via Latina.² Finally, in 26 B.C. he was nominated the first *praefectus urbi*, an office which he resigned after six days in disapproval.³ This marks a stage in his career, which henceforward was not prominent. In 25 B.C. he received money from Augustus⁴ for restoring his burnt house. He was nominated *curator aquarum*⁵ in 11 B.C., and in 2 B.C. moved that Augustus be styled *Pater Patriae*.⁶ Thus he remained faithful to Augustus, but must have disappointed him by his refusal to take part in autocratic government. The *cura aquarum* was given to him by that tactful Emperor as the most distinguished non-political office available. *Curator aquarum*, 11 B.C.—A.D. 13.

2. C. Ateius Capito: *avo centurione Sullano, patre praetorio. Consulatum ei adceleraverat Augustus*,⁷ in 5 B.C. A very distinguished jurisconsult,⁸ of conservative judgement;⁹ author of books¹⁰ on senatorial duties, public trials, and pontifical law. Nominated *curator aquarum*¹¹ in A.D. 13, and also *curator alvei Tiberis*¹² in A.D. 15. *Curator aquarum*, A.D. 13–23.

3. L. Tarius Rufus: *infima natalium humilitate, consulatum militari industria meritis*,¹³ in 16 B.C. He held a command at Actium,¹⁴ and became very wealthy,¹⁵ expending his riches on high-class farming in Picenum.¹⁶ His child, convicted of parricide, was banished by the family council, of which Augustus was a member.¹⁷ *Curator aquarum*,¹⁸ A.D. 23–4.

4. M. Cocceius Nerva: the distinguished lawyer,¹⁹ of the liberal school of Labeo.²⁰ Consul before A.D. 24. In A.D. 26, *comes Tiberii* in Campania,²¹ and an intimate friend of that Emperor.²² Committed suicide in A.D. 33, despite the entreaties of Tiberius.²³ *Curator aquarum*, A.D. 24–33.

5. C. Octavius Laenas: an unknown personage, perhaps the Laenas whose daughter, Sergia Plautilla, married the son of the previous *curator*, M. Cocceius Nerva, and became the mother of the Emperor Nerva.²⁴ *Curator aquarum*, A.D. 34–8.

6. M. Porcius Cato: consul²⁵ in A.D. 36. Had accused Titius Sabinus in A.D. 28, for which Gaius killed him in A.D. 38.²⁶ *Curator aquarum*, ? A.D. 38.

¹ CIL. i², p. 50, 77.

² Tibull., i. 7. 57.

³ Tac., A. vi. 11.

Dio, liii. 27.

⁵ Frontinus, 99.

⁶ Sueton. Vit. Aug. 58.

⁷ Tac., A. iii. 75.

⁸ Ibid., 70, 75.

⁹ Pompon., Digest, i. 2. 2. 47.

¹⁰ Aul. Gell. iv. 14. 1; xiv. 7. 12; iv. 6. 10.

¹¹ Frontinus, 102.

¹² Tac., A. i. 76. ¹³ Plin., N.H. xviii. 37. ¹⁴ Dio, l. 14. ¹⁵ Seneca, De clem. i. 15. 4.

¹⁶ Plin., loc. cit.; cf. CIL. v. 8112. 78, Amphora-stamp, L. TARI RVFI.

¹⁷ Seneca, loc. cit.

¹⁸ Frontinus, 102.

¹⁹ Tac., A. vi. 26.

²⁰ Pompon., Digest, i. 2. 2. 48.

²¹ Tac., A. iv. 58.

²² Pompon., loc. cit.

²³ Dio, lviii. 21.

²⁴ See Prosopogr. ii, p. 427, 29; if this is right, Tiberius chose a family connexion.

²⁵ Ann. Epigr., 1917–18, no. 122.

²⁶ Tac., A. iv. 68, 71.

7 A. Didius Gallus: *curator aquarum*, A.D. 38-49, according to Fontinus;¹ governor of Britain,² 51/2-57/8. Possibly governor of Moesia;³ proconsul of Sicily, consul, and proconsul of Asia or Africa.⁴ The career is an unusual one, since his principal activities appear to succeed rather than precede his curatorship. *Curator aquarum*, ? A.D. 38-49.

8 Cn. Domitius Afer: *summus orator*;⁵ a native of Nîmes;⁶ ex praetor⁷ in A.D. 26; consul⁸ in A.D. 39. *Curator aquarum*, A.D. 49-59.

9. L. Calpurnius Piso: consul in A.D. 57.⁹ In A.D. 62 in charge of *vectigalia publica*, with two other consulars.¹⁰ Proconsul of Africa¹¹ in A.D. 69, assassinated at Carthage,¹² A.D. 70. *Curator aquarum*, A.D. 59-63.

10. P. Petronius Turpilianus: consul¹³ in A.D. 61. Governor of Britain,¹⁴ A.D. 61-3; *insignia triumphalia*,¹⁵ A.D. 65. Tried to come to terms with Galba¹⁶ in A.D. 68, but was killed by him.¹⁷ *Curator aquarum*, A.D. 63-4.

11. P. Marius C[el]s[us]: consul¹⁸ in A.D. 62. *Curator aquarum*, A.D. 64-6.

12. C. Fonteius Agrippa: *cos. suff.*,¹⁹ A.D. 58, June or July: *Proconsul Asiae*,²⁰ A.D. 68; governor of Moesia,²¹ A.D. 69; killed in battle that year.²² *Curator aquarum*, A.D. 66-8.

13. Q. Vibius Crispus: *humili loco natus*;²³ the great pleader.²⁴ A wealthy²⁵ man and native of Vercellae; proconsul of Africa,²⁶ A.D. 71. *Curator aquarum*, A.D. 68-71.

14. M. Pompeius Silvanus: *cos. suff.*, A.D. 45;²⁷ *procos. Africae*, A.D. 58, reus absolutus;²⁸ *legatus Aug. pr. pr. Dalmatiae*,²⁹ A.D. 69-70; *curae pecuniae in Urbe praepositus*,³⁰ A.D. 70; *cos. suff.*,³¹ c. A.D. 74, *cum Tampilio Flaviano*. *Curator aquarum*, A.D. 73.

15. L. Tampilus Flavianus: *procos. Africae*;³² *leg. Aug. pr. pr. Pannoniae*,³³ A.D. 69; *frater Arvalis*, *cooptatus . . in locum . . Galbae*,³⁴ 26 February 69; returns to Pannonia,³⁵ and is saved from mutinous soldiery by Vespasian.³⁶ *Curator aquarum*, A.D. 73-4.

¹ The text reads *huic successit. post quem serasinius celera . . tonio*. Nipperdey's conjecture, *post mensem*, is doubted by Kornemann, *Pauly-Wissowa*, iv. 2, 1786. It is just possible that the text is badly mixed and that a line has vanished after *successit*.

² Tac., *A.* xii. 40; xiv. 29; *Agr.* 14; cf. *JRS.* xii. 62.

³ Tac., *A.* xii. 15.

⁴ *CIL.* iii. 7247 . . . *siae, procos. Siciliae, cons. suff., procos. . . e.*

⁵ *Quintil.* xii. 11. 3.

⁶ Jerome, *Chronicon*, year 2062.

⁷ Tac., *A.* iv. 52.

⁸ *Dio*, lix. 20.

⁹ *CIL.* vi. 845.

¹⁰ Tac., *A.* xv. 18.

¹¹ Tac., *Hist.* iv. 38.

¹² Tac., *Hist.* iv. 48-50.

¹³ Tac., *A.* xiv. 39.

¹⁴ *Agr.* 16; *JRS.* xii. 63.

¹⁵ Tac., *A.* xv. 72.

¹⁶ Zonaras, ii. 13, p. 570D.

¹⁷ Tac., *Hist.* i. 6; 37.

¹⁸ *CIL.* iv, suppl. cli (p. 403).

¹⁹ Mommsen, *Hermes*, xii. 129.

²⁰ Tac., *Hist.* iii. 46; cf. *CIL.* iii. 6083.

²¹ *Ibid.*

²² Joseph., *B. J.* vii. 4. 3.

²³ Tac., *Dial.* 8.

²⁴ *Quintil.* x. 1. 119.

²⁵ Tac., loc. cit.

²⁶ Pliny, *N.H.* xix. 4.

²⁷ Joseph., *Ant. Jud.* xx. i. 2.

²⁸ Tac., *A.* xiii. 52.

²⁹ Tac., *Hist.* ii. 86; iii. 50.

³⁰ Tac., *Hist.* iv. 47.

³¹ Frontinus, 102; *CIL.* iv. 2560.

³² Pliny, *N.H.* ix. 26.

³³ Tac., *Hist.* ii. 86.

³⁴ *CIL.* vi. 1, p. 498, 35-36.

³⁵ Tac., *Hist.* iii. 4.

³⁶ *Ibid.*, 10. 11.

16. M'. Acilius Aviola: *cos. ord.*,¹ A.D. 54; *procos. Asiae*, A.D. 65-6. *Curator aquarum*, A.D. 74-97.

17. Sex. Iulius Frontinus: for details, see pp. 26-33. To his summary, in *De Aquae Ductu*, 102, the list is owing. *Curator aquarum*, A.D. 97-8.

18. L. Funisulanus Vettonianus:³ *IIIvir monetalis; trib. mil. leg. vi*; *Quaestor prov. Siciliae*; *trib. plebis*; *praetor*; *leg. leg. iv Scythicae* A.D. 62; *praef. aerar. Saturni*; *curator viae Aemiliae*; *consul*; *VIIvir epulorum*; *leg. pr. pr. prov. Dalmatiae*; *Pannoniae* A.D. 84-5; *Moesiae*; *curator aquarum*; *procos. Africae*.

19. L. Neratius Marcellus:⁴ *IIIvir monetalis*; *curator actorum senatus*; *quaestor Augusti*; *trib. mil. leg. xii Fulminatae*; *praetor*; *curator aquarum*; *cos. suff.*; *leg. Aug. pr. pr. prov. Britanniae*, 19 January A.D. 103. This seems to have been a praetorian appointment, if the order is correct on the stone, and may imply that Marcellus was an *adiutor*: for the *adiutores* are not distinguished from the chief *curator* on the stone of Didius Gallus.

A long gap now supervenes and suggests that this point may well be chosen for a survey of the appointment, and its conditions, during the first century. It is evident that, if the deaths of Tarius Rufus and of Porcius Cato are excluded, the office was at first reckoned as a long-term appointment, given to distinguished men, usually lawyers whose forensic careers kept them in Rome. After A.D. 59, however, the office was merged in the ordinary senatorial *cursus*, a change doubtless influenced by the Claudian development of the Imperial bureaucracy. Only Domitian would appear to have returned to the earlier practice of making a long-term appointment, which was at once discarded by Nerva and Trajan. The curatorship was in no sense a full-time appointment. The eminent lawyers, who held it at first, were able to carry on their private work simultaneously, while Ateius Capito held another curatorship as well. Cocceius Nerva could leave the City with the Imperial court for Campania; Calpurnius Piso served simultaneously on an important commission. On the other hand, the office was not allowed to coincide with an important function like the consulship. The gap caused by the second consulship of Frontinus, in 98 (not his death, as usually assumed) no doubt explains the rapid succession of Vettonianus: while Vettonianus' proconsulship of Africa left room for the elevation of the praetorian Neratius Marcellus, member of a family then favoured by Trajan. Thus, the office which began as an honour designed for distinguished senior consulars ended as an appointment available in the normal senatorial *cursus*.

¹ Tac., *A.* xii. 64.

² Waddington, *Fasti*, 93, 1-3.

³ *CIL.* iii. 4013, p. 855; xi. 571; xiv. 4016; *E.E.* v, p. 93; Tac., *A.* xv. 7.

⁴ *CIL.* iii, p. 864; ix. 1455, 2456. *JRS.* xii, p. 64.

The next *curatores* known belong to the Severan age.

M. Valerius Bradua Mauricus. *Cos. ord.*,¹ A.D. 191; *pontifex: sodalis Hadrianalis; curator operum publicorum; curator aquarum sacrae Urbis et Miniciae; censitor provinciae Aquitaniae; proconsul Africae*, under Severus and Caracalla. He was a benefactor of Albingaunum, and a lead pipe² found on the Aventine bears his name. *Curator aquarum*, c. A.D. 192–208.

Vibius Egnatius Sulpicius Priscus. *Vir clarissimus*;³ *consul; pontifex et flamen divi Severi; curator aquarum sacrae Urbis et Miniciae eodemque tempore praefectus alimentorum*. Mentioned on the same stone as the foregoing, and on a lead pipe⁴ supplying the *Castra Praetoria*. *Curator aquarum*, c. A.D. 211.

C. Caesonius Macer Rufinianus: probably *curator aquarum* at the end of the reign of Elagabalus;⁵ a member of the Caesonian family who owned property on the Colle Cesarano, near the southern road from Ponte Lucano.⁶ *Curator aquarum*, c. A.D. 222.

L. Caesonius Lucillus Macer Rufinianus:⁷ *Xvir stlitibus iudicandis; quaestor candidatus; praetor candidatus; curator reipublicae Puteolanorum, item Suessanorum, leg. provinciae Africae eodem tempore vice proconsulis; consul; curator alvei Tiberis et cloacarum Urbis; curator aquarum et Miniciae; XXvir ex S.C. rei publicae curandae; proconsul provinciae Africae; praefectus Urbi; electus ad cognoscendas vice Caesaris (Gordian III) cognitiones*. *Curator aquarum*, c. A.D. 238.

L. Valerius Poplicola Balbinus Maximus:⁸ *VIvir equitum romanorum; IIIvir capitalis; quaestor candidatus; praetor candidatus tutelaris; leg. provinciae Asiae; consul ordinarius* (?A.D. 256) *cum Acilio Glabrione; XVvir sacris faciundis; curator aquarum et Miniciae; praefectus alimentorum viae Flaminiae*. *Curator aquarum*, c. A.D. 257.

A fragmentary stone⁹ mentions an unknown holder of the office about this date.

The curatorship is now regularly linked as a part-time office with the *cura Miniciae*, an alimentary office connected with the *congiaria*. This practice continued into the fourth century, but the *cura Miniciae* disappears under Constantine, when the doles were organized anew.

A third group occurs under the Diocletianic régime.

L. Aelius Helvius Dionysius, who was *curator aquarum* before 298, when he became proconsul of Africa, and *praefectus Urbi* in 301.¹⁰

T. Flavius Postumius Titianus,¹¹ apparently *curator* before 301, possibly in 298.

¹ CIL. v. 7783; the office seems to fall towards the end of Severus' reign, since Vibius Priscus is the successor, and *flamen divi Severi*.

³ CIL. v. 7783.

⁴ CIL. xv. 7330.

⁶ PBSR. iii. 130.

⁷ CIL. xiv. 3900–2; vi. 2104, 2086.

⁹ CIL. viii, suppl. 11338.

¹⁰ CIL. vi. 1673.

² CIL. xv. 7556.

⁵ CIL. xiv. 3900.

⁸ CIL. vi. 1531–2.

¹¹ CIL. vi. 1418, 1419?

Nummius Tuscus,¹ *curator* in 302 or 303.

Versenus Fortunatus,² still styled *curator aquarum et Miniciae*. It would seem that the title *consularis aquarum*, used in a rescript of Constantine to this man on 8 March 315³ is a new formula that is anticipating later practice. The stone was found with other similar inscriptions in some fourth-century rooms on the east side of the Fountain of Juturna in the Forum,⁴ which formed a *statio aquarum* in the fourth century. Whether it was the only *statio* of the kind, or whether Cantarelli is right in maintaining that it was too small for the central office of the administration, must be regarded as uncertain; though the passage of Frontinus which he quotes in support of his hypothesis⁵ will hardly bear the sense he puts into it.

Centulius Valerianus, after 315, when Constantine received the title of Maximus.⁶

Q. Flavius Maesius Egnatius Lollianus⁷ who appears as dedicating a statue *cum statione* to Constantine on 1 March A.D. 328. The base on which this inscription is carved was found at the same place as the inscription of Versenus, the existence of which shows that Cantarelli is wrong in saying that the *statio* was established here in 328, for it must have been already in existence. This same Maesius, in the next year, appears as *consularis aquarum*⁸, which now became the regular title, a rescript being issued by Constantine to the next *curator*, Maximilianus, under the same style.⁹ The appearance of the title of *consularis aquarum* in the inscriptions of Titianus and Lollianus is thus premature. Clearly, too, the hypothesis that the *consularis aquarum* took the place of the *procurator*, which is maintained by Kornemann, will not hold.

Towards the middle of the century there is a gap,¹⁰ followed by Eustochius, *consularis aquarum* in A.D. 365, the year of the *prae-fectura urbi* of Caecionius Volusianus.¹¹ The title recurs in A.D. 381:¹² but, according to the *Notitia Dignitatum*,¹³ the *comes formarum*, under the *prae-fectus urbi*, was at the head of the administration soon after this; and, about the beginning of the fifth century, an inscription¹⁴ mentions Julius Felix Campanianus and Tarpeius

¹ CIL. vi. 31378.

² CIL. vi. 37133.

³ Cod. Theod. viii. 7. 1.

⁴ Röm. Mitt., 1902, 72, 73; Top. Dict., 313.

⁵ *Nec suae tantum stationis architectis uti, sed plurium ad-vocare non minus fidem quam subtilitatem*. He wishes to make *suae* mean the central office of the *curator*, as though there had been several *stationes*; but *suae stationis* is opposed to *plurium*, it being suggested that a *curator* will be well advised to take outside advice. See Bull. Com. xxviii, 1900, 72.

⁶ CIL. vi. 31564.

⁷ CIL. vi. 36951.

⁸ CIL. vi. 1723 = 37112; x, 1695, 1696, 4752; EE. viii. 365.

⁹ Cod. Theod. xv. 2. 1.

¹⁰ CIL. vi. 515, denotes M. Aurelius Paconius, *consularis aquarum* at an unknown date.

¹¹ CIL. vi. 3866 = 31963 (*infra*, p. 251). ¹² CIL. vi. 3865 = 31945 (*infra*, p. 253).

¹³ Occ. iv. 5, Ed. Seeck, p. 113.

¹⁴ CIL. vi. 1765 (*infra*, p. 152).

Annius Faustus respectively as *ex-comes* and *comes ordinis primi et formarum*.

(b) *Adiutores*.

The *adiutores*, or technical advisers, are not well known. The first two, who served under Messalla Corvinus, were Postumius Sulpicius and L. Cominius;¹ and the colleagues of A. Didius Gallus were T. Rubrius Nepos² and M. Cornelius Firmus.³ Kornemann⁴ further conjectures that a number of men whose names appear on lead pipes without further descriptions, are probably single *adiutores*. These are M. Arrecinus Clemens under Domitian,⁵ Silius Decianus and Mem(m)ius Rufinus under Trajan,⁶ Aemilius Frontinus under Antoninus Pius,⁷ Calpurnius Maximus⁸ in A.D. 177, and Flavius Secundus under Marcus Aurelius and Commodus.⁹

(c) *Procuratores*.

On the completion of the Aqua Claudia and the Anio Novus in A.D. 52, when the staff was greatly increased in size, the office of *procurator aquarum* was created by Claudius¹⁰ in accordance with his policy of concentrating as much power as possible in the hands of the Emperor by the delegation of authority to the Imperial freedmen. The *procurator* had charge of the *familia Caesaris*,¹¹ and of the funds for its upkeep and for general repairs.¹² He implemented grants of water from the Emperor, transmitted to him through the *curatores*, and was responsible for their correct execution.¹³

The first *procurator aquarum* mentioned in an inscription is Ti. Claud. Aug. lib. Bucolas,¹⁴ who held office under Domitian. There are few inscriptions in which the title is expressly named, but it is probable that all the *procuratores* whose names occur on water-pipes without further qualification were in reality holders of this office, inasmuch as the testing of the pipes was done under their supervision (*sub cura*). Two such men, mentioned only as *proc.* or *proc. Aug.* on the pipes can be shown to be *procuratores aquarum*; while on a third, probably under the Gordiani, a man is called *proc. Aug. n. stationis aquarum*.¹⁵ Where the *procurator patrimonii* is expressly named, the pipes were no doubt laid on Imperial hereditary properties.

The procurators were at first Imperial freedmen; but after the time of Trajan there are isolated instances of *equites*. At the beginning of the third century, the father of Elagabalus, Sextus

¹ Frontinus, 99.

² Cf. CIL. vi. 9245; Pros. ii. 138. 96.

³ CIL. vi. 1248 = 31559 (cf. *infra*, p. 148).

⁴ Pauly-Wissowa, iv. 1787.

⁵ CIL. xv. 72, 72; xi. 428.

⁶ Ibid., 7302.

⁷ Ibid., 7314.

⁸ Ibid., 7360.

⁹ Ibid., 7320.

¹⁰ Frontinus, 105.

¹¹ loc. cit.

¹² Ibid. 118.

¹³ Ibid., 105.

¹⁴ CIL. xi. 3612; xv. 7279, 7280.

¹⁵ CIL. xv. 7338; *ibid.*, vi. 8489 mentions a *servus publicus stationis aquarum*.

Varius Marcellus, is mentioned as *procurator aquarum centenarius*;¹ and the inscription, already cited, in honour of T. Flavius Postumius Titianus was set up by a man who had been *suffragio eius ad procurationem aquarum promotus*.

A pipe of the fifth century² mentions a *tribunus aquarum*, one *Flavius Iohannes V(ir) C(larissimus)*, who appears to have taken the place of the *procurator*. But the *tribunus aquarum* mentioned in an inscription from Tivoli,³ is undoubtedly a municipal official; for in the second century, to which the inscription belongs, there was no such office in Rome itself. This observation also applies to the *curator aquae Tiburt(is)*.⁴ Nor is it likely that the *praefectus rivi supern(at)s*, who was perhaps also *praefectus sal(ientium)*, had any connexion with the aqueducts of the City.

(d) *Aquarii*.

The subordinate members of the staff, collectively known as *aquarii*, were at first the two hundred and forty slave-workmen bequeathed by Agrippa to Augustus, and handed over by him to the State, to be maintained as the *familia publica* by the *aerarium Saturni*, and by the proceeds, often neglected, of the water-rate on private concessionaires.⁵ In A.D. 52, simultaneously with the creation of the *procurator aquarum*, Claudius added four hundred and sixty slaves to the staff, raising it to seven hundred.⁶ These additional slaves were at the charges of the *fiscus*, and were known as the *familia Caesaris*.⁷ Each *familia* consisted of *vilici*, *castellarii*, *circitores*, *silicarii*, *tectores*, and *opifices*.⁸ *Architecti*, *libratores*, and *plumbarii* are also known.⁹

The *familia publica* is not known after Hadrian. Before that date it controlled the Anio Vetus,¹⁰ but it is unknown whether it also had charge of the other pre-Claudian aqueducts.¹¹ Important works were let out to contractors, and only the smaller jobs carried out by the permanent personnel.¹² Before the time of Frontinus the staff was often illicitly employed on private work. He therefore found it advisable to stipulate their programme in writing a day in advance, and to record what they actually accomplished.¹³ The conjecture that the total number of the personnel was raised to seven hundred in order that there might be fifty to each ward is interesting: but, as Hirschfeld¹⁴ points out, the inequality in the size of the Regions must have made an exact division impracticable; and

¹ *CIL.* x. 6569.

² *CIL.* xv. 7260.

³ *CIL.* xiv. 3674, cf. 3689.

⁴ *CIL.* x. 6427.

⁵ *Frontinus*, 98, 116, 118. See also remarks on p. 36.

⁶ *Ibid.*, 116.

⁷ *Ibid.*, 118.

⁸ Overseers, reservoir-men, inspectors, paviors, plasterers, workmen, *ibid.*, 117.

⁹ *Ibid.*, 100, 105, 25.

¹⁰ *CIL.* vi. 33731: cf. p. 79 n. 5.

¹¹ *Ibid.*, 2343, 2345, 8493.

¹² *Frontinus*, 119.

¹³ *Ibid.*, 117.

¹⁴ *Die kaiserlichen Verwaltungsbeamten*, ed. 2, 275 n. 4.

Frontinus¹ expressly states that some of the men were necessarily kept outside the City in order to do small but urgent repairs.

A certain number of inscriptions refer to the various divisions of the personnel indicated by Frontinus, and to *aquarii* generally, mostly to the Imperial slaves. The clerks were generally Imperial freedmen, styled *tabularii aquarum*², *rationes aquariorum*³ or a *commentariis aquarum*.⁴ They were no doubt entrusted with the details of the administration of the funds, which were under the general control of the *procurator aquarum* and out of which the personnel and repairs were paid. It is probable that the *castellarii*⁵ were as a rule assigned to a special aqueduct, as were the *vilici*.⁶ The inscriptions of *circitores*,⁷ *supra formas*,⁸ and *aquarii*⁹ do not mention any one aqueduct in particular.¹⁰ The *castella*, or reservoirs, were fitted with bronze delivery-necks or adjutages (*calices*), through which the water was conducted into the lead pipes (*fistulae*) that conveyed it to its destination. When a grant of water was made, the *libratores* had to test the size of the *calix* and have it stamped as correct by the *vilicus*, and it was incumbent upon the *procurator* to see that this was done.¹¹

¹ Op. cit., 117; cf. p. 200, n. 4.

² CIL. vi. 70 (cf. *Top. Dict.*, s.v. *Castra Fontanorum*).

³ Ibid., 8488.

⁴ CIL. vi. 33731.

⁵ An Imperial slave who was a *castellarius aquae Claudiae* is mentioned in CIL. vi. 8494, while *ibid.*, 8492 speaks of a *castellarius* pure and simple.

⁶ *Vilicus aquae Claudiae* (*ibid.*, 8495); *vilicus aquae Marciae* (*ibid.*, 8496 = 33729); *Vilicus aquae* . . . (*ibid.*, 33732).

⁷ *Ibid.*, 8749; x. 711; xiv. 3649; the last is an inscription of numerous *circitores* at Tibur who probably had charge of the aqueducts which supplied the City of Rome and not of any local aqueduct, cf. p. 200, n. 4.

⁸ *Ibid.*, 8497.

⁹ *Ibid.*, 131, 551, 8491, 33733.

¹⁰ Cf. *ibid.*, 8490 = *M. Ulpus Aug. lib. aquarum*.

¹¹ *Frontinus*, 107.

III. SEXTUS IULIUS FRONTINUS: HIS CAREER, THE *DE AQUAE DUCTU*, AND HIS WORK

THE family of Frontinus and the date of his birth are unknown; but the fact that he was¹ *praetor urbanus* in A.D. 70, an office normally held about the age of thirty-five, would place his birth towards the end of Tiberius' reign. His public services took place at two distinct epochs, at first under Vespasian, when he was *consul suffectus*² about A.D. 74, legate of Britain³ about A.D. 74-7 and later proconsul of Asia;⁴ secondly, under Nerva and Trajan, he took an honourable place in the senatorial co-operation desired by those Emperors. In the interval, like many men who had taken no prominent part in Domitian's government, he occupied his time with writing, composing practical works on surveying,⁵ military organization,⁶ and strategy.⁷ His literary leisure was shared by Martial,⁸ and his military knowledge put under contribution by Aelian⁹ for the *Tactica*. In this earlier phase of his life there were, however, other events which cannot be fitted into the picture. An illness was responsible for a dedication at Vetera¹⁰ to the Capitoline triad. His work on surveying was written under Domitian.¹¹

Not only his legal and administrative abilities, but also his military theory,¹² won him a high place in the regard of Nerva and Trajan. In 97 he was invested with the *cura aquarum*,¹³ to reorganize a service which had become corrupt. He was placed at the head of a Commission on Public Expenditure,¹⁴ and was twice consul, *suffectus*¹⁵ in February 98, and *ordinarius*¹⁶ in 100. These offices laid claims upon his legal abilities, but the membership of the College of Augurs¹⁷ was a life-honour, probably a reward for services rendered. As *augur* he was succeeded¹⁸ in A.D. 103-4 by Pliny the Younger; thus, it is within these years that we must place his death, at something over sixty.

His political sympathies were clearly those of the senatorial party. Both Tacitus and Pliny speak of his character in warm

¹ Tac., *Hist.* iv. 39.

² *CIL.* vi. 2016; cf. Atkinson, *JRS*, xii. 63.

³ Tac., *Agr.* 17.

⁴ Tac., loc. cit.; Mionnet, *Nummi Smyrnaei*, iii. 206, 1121; 210, 1155.

⁵ Lachmann, *Script. geom.* i. 1-58; ii. 101 f., 112 f.

⁶ *Strat.*, preface; Veget. *De re milit.* i. 8; ii. 3.

⁷ *Libri strategematon*, i-iii; the authorship of book iv is in doubt.

⁸ Martial, x. 58. 1-6.

⁹ *De lustruendis aciebus, praefatio*.

¹⁰ *CIL.* xiii. 8624. Ritterling, *Fasti des römischen Deutschland*, p. 57, suggests a governorship of lower Germany in 73-4, comparing the career of Cerialis.

¹¹ *Script. geom.*, Lachmann, i, p. 54.

¹² Vegetius, ii. 3.

¹³ *De aquae ductu*, 1.

¹⁴ Plin., *Panegy.* 62.

¹⁵ Diplom., *CIL.* iii, p. 862 = Martial, x. 48, 20 = Plin., *Panegy.* 61.

¹⁶ *CIL.* viii. 7066; vi. 2222.

¹⁷ Plin., *Ep.* iv. 8. 3.

¹⁸ Ibid.

terms, the one styling him *vir magnus*,¹ and the other *princeps vir*.² He thus belongs to that class of officials who thoroughly believed in the senate, and were out of sympathy with Domitian's theory of the principate. This explains the intense personal interest which inspired him, in every sphere which he entered,³ to write down the precepts of administration and to formulate its theory; for to do this was a confession of faith in the system of short-term officials of the senatorial class rather than long-term professionals of the Imperial Civil Service; and this is an aspect of Frontinus which has been overlooked.

The correct title of the treatise of Frontinus on the aqueducts is *De aquae ductu*. The work has been divided by editors into two books (sections 1-63 and 64-130); but there is no authorization in the text for this arrangement, and the theme runs consecutively between the two. The division should, therefore, be abandoned. All early versions of the text are derived,⁴ through a copy made by Poggio Bracciolini, from the manuscript C 361 at Monte Cassino. This is a twelfth-century manuscript, in which the *De aquae ductu* is copied together with the *De re militari* of Vegetius and part of Varro's *De lingua latina*. A photographic copy of the whole manuscript was published by Herschel as the basis of his edition⁵ in 1899.

The earlier editions need not be enumerated here. In Lanciani's great work,⁶ *I comentarii di Frontino intorno gli aquedotti*, published in 1880, the study of the subject is for the first time placed on a scientific footing; for here the feat of Frontinus is not examined for itself alone, as it had been by Rondelet and others, but is made the basis of the topographical examination of the aqueducts themselves.

Herschel's photographic reproduction has already been noted. It was accompanied by a translation based upon French and German versions, with recourse to Latin scholars where they differed. The rest of the book is a well-illustrated section upon Roman hydraulics in general, in which stimulating suggestions are made. The work does not deal with the course and remains of the aqueducts in detail, and is by no means free from error.⁷ Herschel's

¹ Tac., *Agr.* 17, *vir magnus quantum licebat*.

² Plin., *Ep.* iv. 8. 3; cf. *Ep.* v. 1. 5 on his legal ability.

³ *De aquae ductu*, 1: *in aliis autem libris, quos post experimenta et usum composui, succedentium res acta est*: cf. *infra*, p. 28, n. 2.

⁴ The critical history of the text was worked out by Buecheler in his edition, Leipzig, 1858.

⁵ Clemens Herschel, *The Two Books on the Water-Supply of the City of Rome, of Sextus Julius Frontinus*. Boston, Estes and Co., 1899, pls. i-xxiii.

⁶ *Memorie dei Lincei*, series 3, vol. iv (1879-80), pp. 213 ff.; also separately. I have thought it well to give both pagings.

⁷ See Haverfield in *Classical Review*, xiv (1900), 327, 328, with whom as a whole I am in complete agreement. The explanation of the brick reinforcements as intended to stop leaks in the channel, however, goes back to Belgrand, and is not at all certain.

translation was used to form the basis for that by Professor C. E. Bennett, revised for press by Miss McElwain, which appeared in the Loeb Series.¹ Finally, an edition of the text, by Krohn, was published in the Teubner Series in 1922.

The object of Frontinus in writing the *De aquae ductu* was to inform himself about the service in his control, and to grapple with its technical details, thus reaching a *formula administrationis*.² He felt strongly that 'nothing became a good official less than to run affairs in his charge on the instructions of assistants; which had to be done, whenever ignorance on the chief's part had recourse to their services. Their functions are indeed vital to the service, but in the part of hands or tools of the chief.'³ He thus epitomized for all time the ideal of an efficient civil servant; and chance has preserved to us something of how this ideal of honest service permeated his life. Pliny the Younger, observing⁴ that Frontinus wanted no elaborate tomb, gave his reason. 'The cost', he had said, 'is sheer waste. My memory will endure on its merits.' This is the serenity of a man who had done his duty and knew it.

His summary account of the monuments under his charge is of great value to the present-day investigator, though he himself regarded⁵ it as almost otiose. But his technical investigations revealed an astonishing state of affairs, on the rectification of which he based his claim to have put the service upon a sound footing. In the first place, the amount of water delivered much exceeded the official figures of the available supply: 14,018 *quinariae* (a unit whose significance is discussed below) were reported as actually delivered, while the available supply was reckoned at 12,755 *quinariae*.⁶ To determine the discrepancy, he completely re-estimated the supplies available at the intake of each aqueduct; and the result was still more astonishing, for, although the survey was made in July, when the waters were reckoned to be lowest,⁷ there were 11,605 more *quinariae* then available than in the official computations.

According to Frontinus, the principal cause of the discrepancy which he discovered was an erroneous calculation by the original Imperial administration, whose figures had been accepted without question.⁸ The unit was the *fistula quinaria*,⁹ a pipe one and a quarter digits in diameter, made, according to Vitruvius,¹⁰ thought

¹ See Ashby's reviews in *Times Literary Supplement*, 12 November 1925, p. 755; and in *JRS.* xv (1925), 127.

² Frontinus, 2, *ad meam institutionem regulamque; pro formula administrationis*.

³ Ibid.

⁴ *Ep.* ix. 19. 6, *impensa monumenti super-vacua est: memoria nostri durabit, si vita meruimus*.

⁵ Frontinus, 3, *ne quid praetermisisse videar*.

⁶ Ibid., 64.

⁷ Ibid., 74.

⁸ Ibid., 74, *parum diligenter fecerunt aestimationem*.

⁹ Ibid., 25. Frontinus always uses *quinaria* as a noun.

¹⁰ *Vitr.* viii. 6. 4.

by some to have introduced the standard,¹ from a sheet of lead five digits broad before manufacture. The area of this cross-section, related to the area of the cross-section of water in the aqueduct-channel at the intake, or at some other convenient point, was the basis² of Frontinus' calculation. The supply in the aqueducts themselves was not designed to be a pressure-supply; nevertheless, this basis of calculation leaves out two important factors, the velocity of the current and the differences in the size of the channel. Frontinus was well aware that the rate of fall made a difference to the amount discharged,³ and called in the factor of velocity to explain the figures for the Anio Novus.⁴ But he did not see that these factors upset his calculations of the losses between intake and distribution-tank. A second source of error lay in his reckoning of the consumption from the distribution-tank. He was aware that pipes at different angles to the flow, or at different heights in the tank, consumed different amounts.⁵ To equalize consumption, he thought it sufficient that all the outlets in the tank should be placed at the same height and at the same angle to the current.⁶ But other factors had here to be taken into consideration, for the supply between the tank and the consumer became in effect a low-pressure supply, in which the points governing the consumption are the height of the water in the tank in relation to the outflows, the height of the consumer's outflow in relation to that of his feed-pipe in the tank, the size of pipe used, and the time for which each pipe is flowing. Frontinus took into account only the last two factors, with erroneous assumptions in both. He assumed that the water flowed at a continuous rate, which is uncertain; and, as Herschel pointed out,⁷ his statement that a 20-unit pipe would consume the same amount as four 5-unit pipes is a serious error, for the ratio of flow to flow in two given pipes is not that of their respective cross-sections. Thus, his calculations at both stages in the supply are demonstrably useless as an exact indication of the quantities supplied or consumed. All that can be said for the methods which he used is that they were still employed in Paris,⁸ both in practice and in theory, for the distribution of water from the town reservoirs, up to the middle of the nineteenth century; so long was it before the modern system of hydraulics replaced that of which Rome had been the inventor.

Nevertheless, on the basis of a pipe of *quinaria*-size, and the cross-sectional measurements taken by Frontinus at the source, modern calculations have been made as to the amount of the

¹ Frontinus, loc. cit.

² Ibid., 34.

³ Ibid., 35, *quotiens ex altiore loco venit . . . non tantum respondere modulo suo sed etiam exuberare.*

⁴ Ibid., 73, *velocitate ipsa ampliat modum.*

⁵ Ibid., 36.

⁶ Ibid.

⁷ Herschel, pp. 210-11.

⁸ De Montauzan, *Les Aqueducs antiques de Lyon*, p. 331; and for Rome, cf. p. 174.

supply for each aqueduct. The latest calculation, made by Di Fenizio,¹ and adopted by the *Livellazione*,² takes the *quinaria* at 0.48 litre per second, or 41.5 cubic metres in twenty-four hours: this is slightly above the possible minimum. The result³ then appears in the following table:

	<i>Quinariae</i>	<i>Litres</i> <i>Per second</i>	<i>Gallons</i>	<i>Cubic metres</i> <i>Per 24 hours</i>	<i>Gallons</i>
Appia . . .	1,825	876	193	75,737	16,662,140
Anio Vetus . . .	4,398	2,111	464	182,517	40,153,740
Marcia . . .	4,690	2,251	495	194,365	42,760,300
Iulia . . .	1,206	579	127	50,043	11,009,460
Virgo . . .	2,504	1,202	264	103,916	22,861,520
Alsietina . . .	392	188	41	16,228	3,470,160
Claudia . . .	4,607	2,211	486	191,190	42,061,800
Anio Novus . . .	4,738	2,274	500	196,627	43,257,940
Totals . . .	24,360	11,692	2,570	1,010,623	222,237,060

Thus the figures of Frontinus, if unreliable as an accurate estimate of the supply, still remain the only clue to the capacity of the ancient aqueducts of Rome. It is especially unfortunate in this regard that the two Papal aqueducts, the Acqua Felice, drawn from the springs of the Aqua Alexandriana, and the Acqua Paola, which follows the channel of the Aqua Traiana very closely, should correspond to sources which were not yet tapped when Frontinus was writing. The Acqua Felice delivers 21,633 cu.m. in twenty-four hours, the Acqua Paola 118,127. These figures compare interestingly with some of those given above, suggesting that they are not far from the truth. But calculations from the size of the channel are unsafe. For example, the large *specus* of the Alsietina⁴ would not suggest that the amount of water conveyed by it was so extremely low; nor is the *specus* of the Aqua Tepula⁵ so small in proportion to those⁶ of the Marcia and Iulia as to correspond to the lesser number of *quinariae* attributed to it. Again, the considerable difference⁷ in size between the *specus* of the Anio Vetus and Anio Novus is not reflected in the comparatively small difference in their delivery.

Something must also be said in defence of the former administration, whose figures Frontinus despises. It is evident, from Frontinus' statements,⁸ that these figures were taken, not at the source, but at the point of delivery in the City; and when the City figures

¹ 'Sulla portata degli antichi acquedotti romani e determinazione della *quinaria*', *Giornale del genio civile*, liv. Rome, July 1916.

² Cf. Lanciani, 359 : 570 ff. His figures in *Ruins and Excavations*, p. 58, are a good deal higher.

³ The figures of the Tepula, which are 445, 214, 47, 18,467, 4,062,740, are not included; in the time of Frontinus (*Frontinus*, 68) it was entirely fed from other aqueducts.

⁴ *Infra*, p. 188.

⁵ *Infra*, p. 131.

⁶ *Ibid.*

⁷ *Infra*, pp. 80 and 256.

⁸ *Frontinus*, 65-73.

of Frontinus are compared¹ with the old ones, there is far less discrepancy than his way of stating the facts would suggest. Nor is enough known about the real conditions under which both sets of figures were obtained to justify any distinct preference for those of Frontinus, when both sets are open to the serious errors of which the sources have been indicated above. Making allowance for these errors, there is enough resemblance between the two sets of figures to clear the old administration from the charge of careless work which Frontinus levelled against it. Frontinus, on the other hand, never gave the final figures by which to judge his improvements, because he was waiting² to add in the results of Trajan's new works. Before these were finished, he was out of office and dead.

There is, however, not the slightest doubt that the abuses brought to light by Frontinus were serious enough; and it is upon the correction of these that his claims to ability must rest. These abuses fall into two classes; those committed by the waterworks staff, and those committed by outsiders.

The least harmful abuse on the part of the staff was the tendency of foremen to allow the men to execute private work.³ Frontinus remedied⁴ this by drawing up a daily schedule of work, and noting what was done each day. The most serious was the deliberate tapping of the system. This fraud was perpetrated in three ways. There was a network of secret pipe-lines,⁵ attached to the distribution-pipes, and called 'punctures'. When a water-right was transferred, the workmen put in a new pipe for the new grant, instead of using the old one, whose supply they secretly sold.⁶ Delivery-necks in the reservoirs, which controlled the supply to a given pipe, were either left out, or not stamped as being of the legal gauge, or even deliberately enlarged when so stamped:⁷ the last fraud was the most serious, because it involved the whole staff, the *procurator* included.⁸ A minor method of securing an illegally large supply was to insert the pipe at a lower level in the reservoir,⁹ or to fix immediately behind the delivery-neck a wider pipe than the law ordained;¹⁰ for the first 50 feet of pipe was compelled by law¹¹ to be of the same bore as the delivery-neck. Another striking abuse, corrected by Frontinus, was the stealing of water from the Crabra,¹² a Tusculan brook much used for irrigation by

¹ They run: Appia, *O.* 841, *F.* 704; Anio V., *O.* 1279, *F.* 1348; Marcia, *O.* 2162, *F.* 1840; Julia, *O.* 649, *F.* 803; Virgo, *O.* 652 (? corrupt), *F.* 2504; Claudia, *O.* 2855, *F.* 3312, 1750; Anio Novus, *O.* 3263, 4200, *F.* 4738 at source; Tepula, *O.* 400, *F.* 445.

² *Frontinus*, 88.

³ *Ibid.*, 117.

⁴ *Ibid.*

⁵ *Ibid.*, 115.

⁶ *Ibid.*, 114.

⁷ *Ibid.*, 113, 112.

⁸ *Ibid.*, 105.

⁹ *Ibid.*, 113.

¹⁰ *Ibid.*, 112.

¹¹ *Ibid.*, 105; cf. *CIL.* x. 4842, line 45, Augustan edict from Venafrum.

¹² *Ibid.*, 9; cf. *CIL.* vi. 1261.

local estates, in order to supplement the illicitly-sold water of the Aqua Iulia. Overflows from the reservoirs, very sparingly granted, because needed for sewer-flushing, were also liable to illegal sale.¹ It is, indeed, clear that the whole staff habitually connived at abuses because all had a share in the proceeds from illegal sales. The temptation to a slave to acquire money towards his eventual freedom in this way must have been almost overwhelming. On the whole, the management of the *familia publica* seems to have been worse than that of the *familia Caesaris*. It is astonishing that the *aerarium Saturni*, never in good financial condition, should have allowed to lapse² through neglect or embezzlement water-rentals to the value of two hundred and fifty thousand sesterces. Domitian, discovering the fact, had appropriated the money for the Emperor.³ But Nerva restored it to the Senate, and it fell to Frontinus to put the whole organization on a proper basis.

The connivance of the staff must have been required in order to perpetrate most of the frauds. But Frontinus stigmatizes unsparingly the landowners⁴ through whose estates the channels passed. Not only did they illegally tap the conduits, either quite without permission, or enlarging upon the least favour,⁵ but they encroached upon the water-board's reserved zone, kept free from growth in order to facilitate repairs to the channels.⁶ The planting of trees in this zone was particularly harmful, as their roots, seeking the water, could seriously damage the masonry.⁷ Yet proprietors could use the space for pasture or grass crops, though ploughing was forbidden.⁸ Frontinus was tactful with offenders,⁹ giving them private warning before proceeding to prosecute; for the penalty was a hundred thousand sesterces. But his closing sentence asserts that neither fear nor favour shall prevent his recourse to legal remedies.

But Frontinus was not content with correcting abuses. Definite improvements in the distribution of the supply were introduced during his curatorship. The different types of water were now distributed, in two cases, according to their quality. The Aqua Marcia,¹⁰ sparkling and cold, which had hitherto been largely purloined for baths, fulleries, and latrines, was now largely reserved for drinking purposes. The Anio Vetus,¹¹ a low-level supply of poor quality, was reserved for irrigation and sewer-flushing. The catchment of the Anio Novus¹² was transferred to a point less liable to fouling from the river. So far as possible the public

¹ *Frontinus*, 110-11.

² *Ibid.*, 118.

³ *loc. cit.* In *Domitiani loculos conversum*; this seems to imply the *patrimonium*.

⁴ *Frontinus*, 120; cf. *Plin.*, *N.H.* xxxi. 42, *ambitione avaritiaque in villas ac suburbana detorquentibus*, of the Virgo and Marcia.

⁵ *Ibid.*, 128.

⁶ *Ibid.*, 126.

⁷ *Ibid.*, cf. 120.

⁸ *Ibid.*, 129.

⁹ *Ibid.*, 130.

¹⁰ *Ibid.*, 91-2.

¹¹ *Ibid.*, cf. 90.

¹² *Ibid.*, 93.

fountains, on which the poorer quarters of the City depended for their water, were linked with two supplies, of which one should serve in case of repairs to the other.¹ Several new branches were laid down to the densely populated areas of the Caelian and Aventine, notably an extension of the Marcia.²

In order that the exact data for the different types of channel, requiring different types of repair, might be quickly understood in the Rome office, Frontinus had detailed maps³ prepared, showing the position and sizes of the valleys, bridges, substructures, and tunnels. Decisions about repairs could thus be arrived at more quickly.

Thus, Frontinus was not content to be intimately acquainted with the working of his department and vigilant in correcting its abuses. When the opportunity offered, he introduced improvements of which the value is immediately apparent. The account of his activities gives a picture of a civil servant at work in a Home Department, which is only rivalled by the almost contemporary picture of Pliny the Younger in the provinces. Both represented the best answer that citizen-government could give to the alternative of professional administration by free or slave delegates of the *princeps*. But the fact that, on their own showing, they were exceptional presently decided the fate of the system they represented.

¹ *Frontinus*, 87.

² *Ibid.*

³ *Ibid.* 17, *formas quoque ductuum facere curavimus, ex quibus apparet ubi valles quantaque, ubi flumina traicerentur, ubi montium lateribus specus applicitae . . . ut rem statim veluti in conspectu habere possimus, et deliberare tanquam adsistentes*. Compare the plan of Aqua Crabra, found on the Aventine (*CIL.* vi. 1261); for further references, see p. 46, n. 6.

IV. THE ENGINEERING OF THE AQUEDUCTS

IN creating an aqueduct, the first consideration was the selection of suitable springs. These could not, as now, be tested by chemical analysis; but practical observations and tests were carried out, and are summarized by Vitruvius,¹ whose connexion with the water-supply of Rome and the standardization of pipes has already been noted.² Existing springs must be visibly pure and clear, inaccessible to pollution, and must exhibit outflows free from moss and reeds. The general condition of local consumers should be studied, with special reference to complexion, strength of bone, and clouded eyes. If the source was new, samples should be tested in a good-quality bronze container for corrosion, sparkle, pouring, foreign bodies, and rapid boiling. Vitruvius expected an architect to be proficient in these tests. Agrippa's Aqua Virgo was selected by military engineers,³ whose practical experience in choosing water-supplies can have been second to none.

The springs being chosen, their conveyance had to be considered. Like modern railway engineers, aqueduct-builders had first to consider the question of tunnels and bridges. A limit to the depth of the tunnels was imposed by the method of cutting them: so too high a ridge must not separate the projected source and point of discharge. The tunnelling⁴ was done at measured depths, based on a levelling of the course, from shafts sunk at intervals, error between shaft and shaft thus being reduced to the minimum. On the whole, it was less expensive to skirt a ridge; and the behaviour of the four aqueducts from the Anio Valley in relation to Monte Affliano is instructive in this regard.

Valleys that were too wide and deep presented the same problem as ridges, but in inverted form. The least expensive way, within limits, was to skirt⁵ them, as the Constantinople railway treats the Thracian dales to-day. But valleys that were not too deep could be crossed on bridges. The extent to which Roman engineers used this device is seen more strikingly elsewhere than in the Roman Campagna, at the great bridges of the Gard, or Mérida, or Tarragona, all Augustan works. But this form of transmission greatly added to the expense of the work. The cost of circumventing the gap had to be balanced against that of crossing

¹ *Vitr.* viii. 4; viii. 1 is devoted to the description of suitable geological conditions.

² See p. 28; also p. 161, n. 5.

³ *Frontinus*, 10. It is worth noting that the terms *castra* and *castella* for the reservoirs of large and small size are also borrowed from the military vocabulary.

⁴ *Vitr.* viii. 6. 3; cf. *Tac.*, *A.* xii. 57.

⁵ Cf. Map 4, where Anio Vetus skirts the valleys near Fosso Caipoli, while the other aqueducts bridge and tunnel.

it boldly; and this consideration must be taken into account in studying the finished schemes. Just as some ridges, however, demanded a tunnel and precluded circumvention, so certain valleys, too long to skirt and too deep to bridge, had to be crossed by a siphon. The principle that water thus conveyed rose to its own level was well known, and striking examples of its employment exist. Under the Republic, as early as 134 B.C., Alatri was supplied by a boldly conceived example.¹ The Augustan aqueduct of Arles² crossed the Rhône in that way. All but the earliest aqueduct of Lyon³ traversed the broad glacial cross-rifts in the hinterland by this means. It should be noted that Vitruvius specifies⁴ that the lowest point in a siphon should run level for some distance, and should have vents to reduce pressure. Thus, every attempt was made to avoid the natural creation of a pressure-supply, with which these siphons have often been confused. The siphons were very expensive to build, since the pipes were small ones of lead, arranged in series⁵ to reduce pressure; and no example is certain on the Rome aqueducts except the Palatine siphon⁶ of Nero. Rome's supplies could be acquired without recourse to these expensive pipe-lines, which the limestone deposit of the Anio water would in any case rapidly have choked.

It might be asked why the Romans did not take advantage of their excellent skill in cement manufacture to construct the conduits for a siphon in this material, and so to arrive at the theory of a pressure-supply; for the crushing-resistance of their hydraulic cement exceeds⁷ the figure now accepted as the safe standard. The answer to this question is twofold. The Romans, in using concrete as a constructional material, did not conceive of it as different from the strong rubble grouting⁸ which it actually was; while their cement was not employed except as a supported waterproof lining,⁹ not intended to bear strain. A material of intermediate grade, from which a conduit might have been built, was indeed used for vaulting, but it was still conceived as fine rubble in-filling.¹⁰ In fact, the idea of crushing-tests implies an

¹ Erected by the *ensor* Betilienus Varus; see *Boll. Inst.*, 1865, p. 65, *Not. d. scæv.*, 1879 and, better, 1882.

² Formigé, *Les Monuments romains de la Provence*, p. 17: Constans, *Arles antique*, 400.

³ De Montauzan, *Les Aqueducs antiques de Lyon*, *passim*; summary, p. 177.

⁴ viii. 6. 5-6.

⁵ See De Montauzan, *op. cit.*, p. 104, fig. 20; pipes were 20 cm. bore; Formigé, *loc. cit.* It is interesting to compare modern practice on the great pipe-lines for oil in Persia. J. W. Williamson (*In a Persian Oil-field*, p. 88) notes: 'By introducing extra parallel lengths of pipe at places where the graph showed local increases of pressure the graph showing the fall of pressure was smoothed out; in other words, the pressure drop along the pipe was made gradual instead of being jerky, and, in particular, the development of dangerous pressure at certain points was avoided.'

⁶ See p. 250.

⁷ De Montauzan, *op. cit.*, pp. 269-70, for tables and figures.

⁸ *Vitr.* ii. 8. 7.

⁹ *Vitr.* viii. 6. 15.

¹⁰ *Vitr.* v. 10. 3, calls it *structura*.

experimental basis for theory and practice which Roman literature and the structure of Roman civilization give no warrant to assume; yet this experimental attitude alone made possible the invention of concrete pipes. Secondly, concrete pipes were invented to meet the needs of a high-pressure water-supply. But Roman siphons, as already noted, were designed and provided with every device to reduce pressure. Roman needs, as conceived by the public authorities of the day, did not demand a high-pressure system. The theory and practice in water-supplies was based on the view¹ that aqueducts supplied the general public and not the private consumer; they served primarily the street-fountains,² whence the public drew its water, and secondarily the public baths.³ Not only did these institutions demand a continuous flow,⁴ to render which a high-pressure supply is not required, but their overflow was continually required for sewer-flushing. In the absence of sewage works, the essential insurance of public health was a continual flushing of the drains.⁵ Only when these needs had been met⁶ were the manufacturer and private consumer considered; and they were supplied, not with what they demanded, but with what could be spared. Their payments for supplies were, indeed, a source of revenue to the water-board.⁷ But there was no fixed policy of raising even sufficient revenue to cover the expenses of the board⁸ by meeting a demand, still less by creating one. Yet it was the development of this theory, that the well-served private consumer can pay for the public services, which was the basic reason for the creation of the modern pressure-supply. The Roman method met the public need as then conceived, and the theory which created modern municipal undertakings had not yet been formed. Thus, to ask why the methods used on a deliberately designed gravitational or low-pressure system were not superseded by those which served a high-pressure system as yet unconceived, is really a *petitio principii*. Granted the Roman outlook, it is idle to consider whether they could have solved a problem to which they had not applied their minds. The essence of the question is not in hydraulics but in economic philosophy.

In short, the Roman theory⁹ of water-supply was to use a gravitational flow, aided by a small fall in the conduit. The siphons made skilful use of the principle that water rises to its

¹ *Frontinus*, 94, 95; *Vitr.* viii. 6. 2: there was naturally a continual struggle to prevent the encroachment of the private consumer.

² *Frontinus*, 104, *sub fin.*; *Vitr.*, loc. cit.; *vide infra*, p. 153.

³ *Vitr.* loc. cit.; cf. *Frontinus*, 3.

⁴ *Frontinus*, 103, *sub fin.*

⁵ *Ibid.* 111, quoting an unspecified Emperor, *hoc pertineat non solum ad urbis nostrae salubritatem, sed etiam ad utilitatem cloacarum abluendarum.*

⁶ *Frontinus*, 103; *Vitr.* loc. cit.

⁷ *Frontinus*, 118; *Vitr.* viii. 6. 2.

⁸ *Ibid.*

⁹ *Vitr.* viii. 6. 1.

own level, but they were in no sense an anticipation of a high-pressure supply. Pressure in the conduits was created, if at all, by accident and avoided in practice. Only in pumps¹ and in water-organs² did pressure find a place in the Roman theory of hydraulics.

When a general line had been determined on the foregoing principles, the next step was a careful survey of the projected course, with a view to determining levels. Surveyors used three machines: the *dioptra*,³ an instrument which measured horizontal angles like a theodolite and sighted on a levelling staff, but had no telescopic sights; the *libra*,⁴ a simple water-level, which must later have served in making the individual sectors in the tunnels; the *chorobates*,⁵ or field-service level, a large level some twenty feet long, adjusted alternatively with plumb-lines or a large water-level. Vitruvius himself thought⁶ that the *chorobates* did the most accurate work, and, failing telescopic sights on the *dioptra*, he was probably right. But it must have been an intolerably cumbrous instrument to use, and for rapid work men must have employed the *dioptra*. The *chorobates* may well have served in the constructional stages, and Vitruvius may be guilty of an architect's prejudice in favour of an instrument more useful to the builder than to the field-surveyor.

Tables exist⁷ of the average fall in the Roman aqueducts of France. But average figures are of little service when the single items which compose them are unspecified. The average fall of the Rome aqueducts is calculated as about 2%.⁸ but there are a number of short sectors in which it is a great deal higher, and many places, on the other hand, where it is lower. It seems certain that there is no continuity or consistency in the fall, which varies greatly between adjacent points.

In the Anio Novus the highest falls noted are 60.7%, in part of the late sector between I. 65 and I. 64; 34%, just after I. 57;⁹ and 33.5% between I. 43 and I. 42, which is an original sector. In the sectors carried on arches the figures are very much lower,

¹ *Vitr.* x. 7. 3, *cogunt et extrudunt inflando pressionibus.*

² *Vitr.* x. 8. 5, *aera . . . pressionibus coactum . . . cogunt.*

³ See H. Schoene, *Heronis Alexandrini opera*, vol. iii (Teubner), pp. 192-3, figs. 83 a, b.

⁴ *Vitr.* viii. 5. 1.

⁵ *Vitr.* viii. 5. 1-2.

⁶ *Loc. cit.*, *dioptrae libraeque fallunt.*

⁷ De Montauzan, *Les Aqueducs antiques de Lyon*, p. 171.

⁸ *Livellazione*, 75. *Vitr.* viii. 6. 1 advises not less than one half per cent.; cf. pp. 38-9. The lack of uniformity between the Marcia and Claudia had already been noted by Fabretti, who saw that the arches of the former, near the 5th mile of Via Latina, were 20 feet below the Claudia, and at the Porta Maggiore 25½ feet below it; so that in this distance one had fallen 5½ feet more than the other.

⁹ This is not given in the *Livellazione*, and may be due to some variation in the line of the aqueduct.

and do not rise above 10%,¹ while they do fall as low as 0.51%,² the Vitruvian minimum. But even lower figures are to be found; 0.14% and 0.2% between I. 56 and I. 54, and 0.3% between I. 10 and I. 9.

The Aqua Claudia has the following maximum falls in the course of the main aqueduct: 28.2% just after II. 30; 16.4% between the Ponte Scalino and the Ponte Amato (II. 12 and II. 11); 14.50% between II. 26 and 25. The lowest figures are 0.20% in the stretch behind Vicovaro station,³ 0.31% between II. 32 and II. 21. The branch in the gorge of S. Cosimato, which belongs to the time of Hadrian, has a fall on the down-slope of 2.81%.³ In the sectors on arches there is a fall of 38.95% on the bridge over the Fosso di Pallavicina (II. 9) and of 7.9% on that at Fonte Luca (II. 24); but it is only 0.90% on the Fosso Maiuro bridge (II. 27), while in the long line from Capannelle to Rome the figures vary from 1.98 to 1.45%.⁴

The Marcia also has some considerable falls: the highest are between III. 12 and II. 11, in the descending channel near the Casale Acqua Raminga, where the figure is 107.35% for the main part of the slope.⁵ On the main course of the aqueduct the highest figures are in the gorge of S. Cosimato, 23.90% between III. 32 and 31 and 13% between III. 33 and 32; in the tunnel between the Fosso Caipoli and the Ponte della Bulica (III. 7 and 6) where the fall is 15.2%; and a 10% fall occurs along the Via di Carciano (III. 15 and 14). Elsewhere the figures are lower—0.30% between III. 25 and 24, 0.35% just after III. 14, and 0.59% between III. 23 and 22. In the sector on arches between the Podere Saccardo and Rome the fall is 1.53%.

The Anio Vetus exhibits less variable figures. But it has been levelled at comparatively few points, so that too much reliance should not be placed on this. The lowest figure is 0.95%, between IV. 16 and 15. An exceptional fall of 163.5% occurs in the short-circuit which Hadrian built across the Fosso della Mola di S. Gregorio (IV. 6g); but this is only 25 m. long, and is necessitated by the fact that the difference in level was originally distributed over a greater distance.

These figures demonstrate that there was a substantial difference between the gradients on arches and those in the tunnelled sectors. The average figure shows that the initial selection of

¹ On the upper bridge at Fonte Luca (I. 46). It should here be noted that the real fall between I. 5 and 4 is 3.92 as in the section: 3.22, in *Livellazione*, p. 76, is a misprint.

² On the late sector between I. 40 and I. 39.

³ Between II. d q, and II. 33.

⁴ 2.88 (*Livellazione*, p. 76) is probably exaggerated, and in any case the basis of comparison is unsound.

⁵ The figure of 150.6‰ for the first 25.40 m. is arrived at by a comparison of the intrados in both cases, and may therefore be slightly excessive.

key-points must have been carried out carefully, with regard for reasonably accurate work. But the margin of error in the tunnelled sectors was left very large, probably intentionally. The figures from the arched sectors, on the other hand, do not compare unfavourably with the Gallic figures from Lyon,¹ excluding the siphons. Here, on courses worked with substructures, the Mont d'Or conduit ranged from 0.10% to 0.13, 0.21 and 0.70%; while the duct of La Brévenne gave minima of 0.070%, 0.085%, and 0.134%, and maxima of 3.4%, 4.5%, and 9.8%. These are Imperial works. In Rome, it is evident that the standard approached in the Anio Vetus of 272–271 B.C. differs little from that attained by the engineers of Gaius and Claudius, some three centuries later.

The next procedure was the acquisition of the necessary land. This was bought out by the State or municipality, but there was no means of compelling a recalcitrant proprietor to sell. Neither in this nor in other public works were there rights of expropriation.² Thus, in 179–178 B.C., Licinius Crassus³ was able to cause the abandonment of a scheme by refusing right of way to the projected channel. Accordingly, the government adopted a generous attitude to the seller, buying out the whole field in which the required strip lay, and re-selling the portion not required.⁴ To permit the aqueduct to pass through free of charge was considered at Vienne⁵ an act of generosity worth public commemoration. The strip thus acquired was in the Roman aqueducts 15 feet on each side of the structure outside the City, and 5 feet in the case of subterranean works and works inside the City.⁶ Boundary-stones⁷ were first introduced by Augustus and Tiberius, and the extant examples permit the conclusions detailed in the next

¹ De Montauzan, *Les Aqueducs antiques de Lyon*, pls. iii (Mont d'Or) and iv (La Brévenne), whence these figures are extracted.

² Cf. Suetonius, *Divus Iulius*, 26, 2, on the Forum Iulium; *Divus Aug.* 56. 2.

³ *Livy*, xl. 51. 7.

⁴ *Frontinus*, 128.

⁵ *CIL.* xii. 1882–9.

⁶ The Loeb translation is here inaccurate: the text is *et circa rivus qui sub terra essent et specus intra urbem . . . quinos pedes*. Eight feet at Venafrum, *CIL.* x. 4842.

⁷ The *cippi* of the various aqueducts are dealt with as they occur, but three, now to be cited, cannot be given a place. *CIL.* vi. 31569 = 1249a has vanished since Massimo (*Notizie istoriche della Villa Massimo* (1836), p. 19) saw it standing in the Villa. Its material is not precisely stated. Massimo assigned it to the Marcia, Tepula, or Julia, giving the uninformative text as | IMP. CAESAR | DIVI. F | AVGUSTVS | EX S. C. | | P. CCXXXX. Secondly, *CIL.* vi. 31570 = 1243g = xiv. 4085, seen in a Tivoli church, has part of an Augustan text left, but no name or number; it may belong to either Anio Vetus or Marcia, both mutilated in the same way. That there were two *cippi*, as Henzen and Lanciani (46 : 258) believed, is rightly rejected by Dessau and Hülsen. Finally, *CIL.* vi. 31571 = 1255 was copied by Mancetus and Cittadini near S. Maria Maggiore, in the 16th century, as TI. CAESA(r divi Aug.) | F. AVG(ustus) | PONTIF(ex max.) | CCCXCV. Cittadini draws it rounded at the top, and broken to right. Hülsen doubts that it was from an aqueduct. No name was seen towards the top of the stone, and the number is far too high for any *cippus* in Rome. A supposition that it had been brought in from far is most unlikely.

paragraph. Meanwhile, it should be noted that the reservation¹ of the strip did not hinder access for pasture, cutting of grass or hay, and collecting brushwood; it forbade either planting or building, and reserved a perpetual right of way to the company's officials or delegates. The commissioners also made exceptions to the rule within enclosed property.²

Both dimensions of the reserved strip ('*zona di rispetto*') indicated by Frontinus are confirmed by actual stones. Pair ciii, of the Aqua Marcia,³ lay with inner faces 3.60 metres (12 Roman feet) from the foundations of the aqueduct 4 m. (13 feet) wide: thus, the total width delimited was about 38 Roman feet, of which 8 go to the aqueduct-piers above ground level. Again, pair xxiv on the same aqueduct⁴ were each 4.10 m. (13 $\frac{2}{3}$ Roman feet) from the pier, or, adding their thickness, 14 $\frac{1}{2}$ feet. The smaller dimension is confirmed by two pairs of *cippi* of Aqua Iulia⁵ found in Tenuta Bertone (cliv and clvi) which were each 3.99 and 3.802 m. apart, or, adding their own thickness, 4.500 and 4.338 m. (15 and 14 $\frac{1}{2}$ Roman feet). This is a subterranean *specus*, taking 5 feet for its own width, and leaving 5 feet on each side of it.

The *cippi* have also been thought, from Fabretti's time, to mark distances along the aqueduct, the stock interval being 240 feet (2 *actus*) or 71.28 m. But, since various *cippi* are exceptions to this rule,⁶ Huelsen, in *Corpus inscriptionum*, followed Garrucci's opinion,⁷ that the *cippi* in general marked the *putei*, as some do; for *putei*, according to Vitruvius, should be two *actus* apart, and some are. Yet *cippi* and *putei* are not always⁸ coincident. It was difficult when the aqueduct was underground, especially in the City, to place the *putei* at precise intervals: but even in arched sectors, where the inspection-shafts could easily have been placed at regular intervals, this does not happen.⁹ Thus it does not appear that any precise rule was observed.

As for the way of meeting the cost of the aqueducts, it has already been noted that the financial theory upon which the provision of a water-supply was based differed profoundly from that of modern times. If no attempt was made to balance receipts and running-costs, still less was there any thought of paying for the initial cost out of eventual receipts or capital reserve. The Republican aqueducts of Rome were built by the Treasury, but not on the basis of tax-receipts. The earliest details of costs

¹ Frontinus, 129.

² Ibid. 127, 129.

³ *Infra*, p. 134.

⁴ *Infra*, p. 143, n. 3.

⁵ *Infra*, p. 164.

⁶ Anio Vetus, *a*, 230 ft.; *b*, 320 ft.; Marcia-Tepula-Julia, *a* (402), 425 ft.; *b* (361), 350 ft.; Marcia, *i*, 250 ft. Cf. Marcia, 1197 and 1215, from near the springs, where the aqueduct must have run nearly straight, and the actual distance is 1030 metres. This gives an average of 192.33 Roman feet per interval, see p. 94.

⁷ *Bull. d. Inst.*, 1861, 39; *Civiltà Cattolica*, ser. 4, vol. ix, p. 737.

⁸ *Infra*, p. 128.

⁹ See Lanciani, 87 : 299 ff.

apply to the Anio Vetus,¹ of 272–271 B.C. This was paid for by the spoils of the Pyrrhic War. Actually, it is one of the earliest examples of a system of public finance which deliberately embellished the Roman State, and more particularly the City itself, by means of war-booty. But what began as a boon became a fixed policy, recently traced in some detail,² of expecting spoils or gifts to pay for public works, and thereby slowly imposing an obligation upon successful public men to build such things. The making of aqueducts was kept in the hands of the State, but the ultimate source of the funds was in every case the same.

Thus it came about that the accidental influx of booty to the State created a theory of payment for public expenditure which was thoroughly unsound. It acquired wealth by robbery instead of the sounder medium of exchange; it impoverished newly conquered regions, and drained the older provinces of their resources by war-levies; it prevented the formation of any sound theory of public economy. Gradually, too, the burden came to be transferred from the State on to the shoulders of the *virī triumphales*, thus preparing the way for the concentration of benefactions in the gift of successful commanders, like Sulla, Caesar, Augustus, and Agrippa. So it came about that the greatest extension of the aqueducts, at the hands of the last two named, was borne by private individuals, whose fortunes were based upon war-booty.

The consequences of the policy became yet more serious when a state of war ceased to be chronic, and the Empire ceased to war with wealthy opponents. The fact that the Emperor, or his treasury, then took over the responsibility for public works in Rome, only disguised the evils inherent in an unbalanced system. The *fiscus* was expected to pay for the large constructions, as for the Claudia³ and Anio Novus,⁴ but did so largely by bleeding the taxpayer, instead of turning the undertakings to profit. But perhaps more serious was the extension of the fashion of personal benefactions to the municipal system of the Empire at large. This led to a steady absorption of private capital in public enterprise, with no return in income to the capitalist and no return in permanent local employment commensurate with the capital involved. The whole system was sterile and as unproductive of sound prosperity as it is possible to conceive.

The contracts for the work were let out under the Republic by the *censores*,⁵ and under the Empire by *curatores*⁶ acting as the Emperor's agents. It is likely enough that the three main classes

¹ *Frontinus*, 6; cf. p. 55.

² F. W. Shipley, *Mem. Amer. Acad. Rome*, ix, pp. 9–12.

³ See p. 190, n. 5.

⁴ *Ibid.*

⁵ Cf. Aquae Appia, Anio Vetus, Marcia, the unfinished work of 179 B.C., and Aqua Tepula.

⁶ *Frontinus*, 119.

of work to be done, low substructures and small cuttings, tunneling, and bridge-building, were let to different kinds of contractors. The bridging¹ for the abortive work of 179 B.C. was thus to be tendered for separately; while one contractor,² Paquedius Festus, undertook Domitian's work on Aqua Claudia under Monte Affliano. But other testimony on the point is wanting, and the many restorations which the actual works have undergone do not permit conclusions to be drawn from the work itself.

On the general principles applied to the catchment of springs ancient authorities have little to say; Vitruvius³ gives careful instructions for digging the adits to subterranean supplies, which were to be tested by a trial shaft, and afterwards tapped by tunneling at different points with an ultimate combined outlet. So little is known about the type of catchment used on the Rome aqueducts that no general rule can be established for them; but the rather vague evidence for the Marcia⁴ and Claudia⁵ suggests that there were numerous adits, and the same is more certainly ascertained for the Aquae Appia,⁶ Virgo,⁷ and Traiana.⁸ Settling-tanks⁹ were not uncommonly associated with the catchment-channel, and have been mistaken for an actual catchment-basin.¹⁰ But catchment-basins, though frequently used by Roman engineers,¹¹ were devised for catching streams or surface-water rather than for tapping springs. The Anio Vetus took its water direct from the Anio,¹² but the method of ensuring and regulating the supply is unknown. This river also supplied the Anio Novus, but in Trajan's day¹³ the source of supply was changed to Nero's artificial lakes on the same river, where the supply was controlled by sluices.¹⁴ Thus, all the known methods were in effect employed.

On leaving the springs or basin, the water entered the aqueduct-channel proper (*specus*). Vitruvius mentions¹⁵ stone-built ducts, stone pipes, lead pipes, earthenware pipes, and leather pipes: to which may be added open ducts of masonry¹⁶ and wooden pipes.¹⁷ In Rome, the lead pipes occur at a later stage, and Vitruvius did not favour them because of the dangers of lead-poisoning:¹⁸ the aqueduct-channels were all of the built kind.

¹ *Livy*, xl. 51. 7.

³ *Vitr.* viii. 1. 6.

⁶ *Frontinus*, 65.

⁹ *Frontinus*, 7 (Marcia), 10 (Virgo), 11 (Alsietina), 15 (Anio Novus).

¹⁰ Cf. *Lanciani*, p. 331 : 543, basing his view on the Aqua Virgo, where digging certainly had to be done: the *opus signinum* work was round the springs (*scaturigines*), see *Frontinus*, 10.

¹¹ Cf. Mérida, *Monumentos romanos de España*, Pantano romano, llamado de Proserpina.

¹² *Frontinus*, 90.

¹³ *Ibid.*, 93.

¹⁵ *Vitr.* viii. 6. 1; 6. 8. For a remarkable example of a duct of stone pipes (*lapides perterebrati*), see p. 154; cf. Paris and Bonsor, *Fouilles de Belo* (Bibliothèque de l'École des Hautes Études hispaniques, fasc. vi. vol. i), p. 114, fig. 35, aqueduct at Palomós. A Jerusalem example is figured by H. V. Morton, *In the steps of the Master*, p. 116.

¹⁶ *Arch. Ael.* ser. 4, viii. 202.

¹⁷ *Archaeologia*, lv. 422.

² *CIL.* xiv, 3560.

⁵ *Infra*, p. 190.

⁸ *Infra*, p. 300.

¹⁴ called *saepa*, *CIL.* x. 4842.

¹⁸ viii. 6. 11.

The channels above ground are built of stone slabs, keyed with cement-filled slots, or of concrete faced either in blockwork or rubble in the older cases, or in reticulate or brick in the Imperial work, with late repairs in block-and-brick or in mixed rubble. Details of this work are carefully studied in Dr. Van Deman's book,¹ upon which it is unnecessary to impinge. The lining is of fine cement, in two or three coats, as Vitruvius recommends.² Below ground, the character of the work depends upon the depth and nature of the soil. If a trench can be dug, this is done, and the conduit built at the bottom without external facing.³ If tunnelling is necessary, vertical shafts are sunk and provided with foot-holes cut in the side, and from these the tunnel is extended at the required depth in either direction.⁴ Whether, under these circumstances, the tunnel and shafts were built or cut in the solid rock, depends upon the ground; but most of the Rome aqueducts are tunnelled in the rock.

The sizes of the various Rome aqueduct-channels are given in the Appendix. The method of covering them varied very considerably, even in the same aqueduct. In nearly all cases⁵ the section of the *specus* is rectangular up to the impost; but the roof may be flat,⁶ gabled,⁷ or vaulted,⁸ and the external section may differ from the internal.⁹ Above ground the covering was necessary to keep out the rain and to preserve the waters from the heat of the sun.¹⁰ The roof was not provided to retain a supply at pressure, and the side of the rock-cut *specus* of Aqua Claudia in the gorge of S. Cosimato contains windows at a little above half the height of the channel.¹¹ There is hardly enough evidence available to determine whether the different kinds of roof correspond to work by different contractors on the original building, or to subsequent repairs.

In order to facilitate the original construction in the tunnelled sectors, and the subsequent inspection or cleaning of the whole line of channel, shafts¹² (*putei*) were made, sometimes round and sometimes rectangular or square, and descended by foot-holes. It has been thought that these were placed at the regular distance, specified by Vitruvius,¹³ of 240 feet (two *actus*), and this actually happens in some cases; but it is by no means a universal rule, and the *putei* are often closer.¹⁴ Nor are they specifically related to the *cippi*, or regularly-placed boundary-stones.¹⁵ The workmen's path¹⁶

¹ *The Building of the Roman aqueducts*, Washington, 1934.

² viii. 6. 15. Vitruvius does not mention the quarter-round moulding at the junction of sides and bottom: but this was universal.

⁴ vii. 6. 3.

⁵ The Appia may have been repaired differently, see p. 52.

⁶ pp. 53, 112, 227, 256, 312.

⁷ pp. 59, 107, 203, 262, 310.

⁸ pp. 80, 194, 258, 306, 312.

⁹ pp. 60, 265.

¹⁰ *Vitr.* viii. 6. 1.

¹¹ p. 195.

¹² pp. 76, 115, 126, and *passim*.

¹³ *Vitr.* viii. 6. 3.

¹⁴ pp. 70, 128, 280.

¹⁵ p. 128.

¹⁶ p. 93.

naturally followed the *putei*, and took the best course available above ground. On the Anio Vetus, at Fosso della Mola, it is actually provided with a special bridge.¹ But on the raised sectors the inspection was normally made from the top of the *specus*. The tendency of the Anio water to encrust² the channels with a thick deposit was one of the chief cares of the repair department, for the channels thus affected needed continual cleaning; failure to observe this has resulted, as can be seen in many places to-day, in total blocking of the channel. But the piles of extracted deposit form a valuable clue in tracking the position of the vanished *putei* and channel. Lanciani was able to recover very largely the underground course of the four great aqueducts in the Campagna by using this test.³

Once the aqueducts were built, maintenance, apart from the cleaning of encrusted channels, tended to demand repairs at three principal points, according to Frontinus. The hill-side sectors and the bridges across valleys were liable to damage by heavy storms and spates.⁴ Any one familiar with the effects of torrential winter rains in the Campagna will appreciate this. Great heat and frosts⁵ were liable to cause leaks in the channel, and this must have been especially liable to occur in the stone-built channels,⁶ whose stability depended upon fine horizontal jointing and a thin key of cement in vertical slotted joints. The stone arches near the City caused perpetual anxiety, partly because the tufa piers were carrying loads bigger than those originally designed and tended to give way,⁷ and partly because the channels were superimposed:⁸ the newer work, that is, the work of Claudius, had also been badly done.⁹

The actual repairs to the aqueducts reveal that Frontinus had accurately summarized their weak points. As he observes, the underground sectors required little attention.¹⁰ But the bridges needed continual reinforcement, owing partly to the dangers of stream erosion and partly to the wind-stresses on the arches. Eventually, it was thought wise¹¹ not only to buttress heavily but to underpin the arches of the monumental sectors in the Campagna, where the dangers must have arisen not only from overloading and wind-strain but also from earth-tremors. Their eventual collapse, definitely to one side, is no doubt to be ascribed to earthquake action.¹² But it is clear that the normal work was the routine of stopping minor leaks, anticipating damage due to weathering or the growth of trees,¹³ and cleaning the channels.

¹ p. 73. ² *Frontinus*, 122. ³ See Dr. Ashby's remarks in our Preface, p. xii.

⁴ *Frontinus*, 121. ⁵ *Ibid.*, and 123. ⁶ pp. 132, 239. ⁷ *Frontinus*, 122.

⁸ *Ibid.*, 124. ⁹ *Ibid.*, 120. ¹⁰ *Ibid.*, 121. ¹¹ See pp. 137, 235.

¹² De Montauzan, *Les Aqueducs antiques de Lyon*, pp. 404-5 underestimates this factor and dates the reinforcements too early. ¹³ *Frontinus*, 126.

The only fundamental mistake was that of overloading the piers with extra channels; major repairs were necessitated by agencies beyond human control, anticipated within reasonable limits.

According to the theory of Vitruvius,¹ the water-supply, on reaching the town, was divided into three equal parts: for public basins and fountains, for public baths, and for private consumers. But the first pipe was so arranged² that it was to benefit from any surplus in the flow. There are clear traces of the application of this theory in the primary *castellum* of the Minturno aqueduct,³ which has three main discharge-pipes, and in the *château d'eau* at Nîmes,⁴ where three main pipes catch the maximum flow and ten others draw equally from a higher level in the tank. The Nîmes example is, in fact, a primary and secondary reservoir combined. Another fine example was examined by De Montauzan at Thuburbo Minus,⁵ showing the same triple division, in this case regulated by sluices with shut, half-open, and fully-open positions. At Rome the system as a whole was naturally much more complicated, for there were many main sources of supply, and many more public buildings and private clients to be served. Yet the same principles were followed, for the public reservoirs contained the same system⁶ of large pipes running to secondary reservoirs whence the private distribution was made. The improvement of having an emergency source of supply, for use during repairs, was introduced in Rome under Frontinus,⁷ and was probably rare elsewhere, though many big towns had more than one aqueduct.⁸

An example of the secondary reservoir, or distribution-chamber for private consumers has yet to be sought, though there is a tradition of one having existed at Lyon.⁹ Similarly, the measured delivery-necks (*calices*) with which these *castella* were supplied in Rome, and probably elsewhere, are to seek. Certain bronze pipes now in museums have been identified as such, but amid considerable variance of opinion;¹⁰ according to Frontinus,¹¹ legally

¹ *Vitr.* viii. 6. 1 and 4, where *moenia* certainly means town-wall.

² *Vitr.* viii. 6. 1-2, *uti cum abundaverit ab extremis, in medium receptaculum redundet. Ita in medio ponuntur fistulae in omnes lacus et salientes.* The device was to give the public the advantage of any surplus.

³ See *JRS.*, vol. xxiii, p. 155, fig. 5.

⁴ De Montauzan, *Les Aqueducs antiques de Lyon*, p. 316, mistakes the three main outflows for waste-pipes.

⁵ *Op. cit.*, p. 317, fig. 125.

⁶ Frontinus, 106, s. c. of 11 B.C.

⁷ Frontinus, 87, *lacus tam novi quam veteres plerique binos salientes diversarum aquarum*; the Loeb translation is in error in taking *plerique* with *novi* as well as *veteres*.

⁸ Cf. Lyon, with at least four; Mérida, three; Vienne, at least two; Arles, two.

⁹ De Montauzan, *op. cit.*, p. 320.

¹⁰ Lanciani, pp. 363 : 575, accepted *CIL.* xiv. 2010 = xv. 7212, inscribed *Fl. Gregorii v.d.* and now in the Vatican, and *CIL.* xv. 7213, *Fl. Rustici v.h.* (cf. Paribeni, *Guida al Museo delle Terme*, p. 295, no. 933), now in the Terme Museum. Dressel ad loc. refuses to admit these, in which Herschel followed him (p. 207). Herschel adduces three from Pompeii (*ibid.*): these are accepted by Di Fenizio, together with two more from the Museo delle Terme.

¹¹ Frontinus, 105.

accepted examples should be stamped by the water-bailiff of the reservoir, with the surveillance of the *procurator aquarum*. Large private houses also had their own tertiary distribution-chambers, of which examples are known.¹

Finally, the overflow (*aqua caduca*) from primary reservoirs, fountains, or public baths, was also distributed, for manufacturing purposes or for swilling. In Rome, most of the supply was naturally absorbed for the latter purpose.² But the overflow from the Aqua Traiana was used for manufacturers on the Janiculum:³ and mills were arranged in the basement of the baths of Caracalla.⁴ A fine example of the use of such water was discovered at Wroxeter,⁵ Viroconium Cornoviorum, in 1914, though imperfectly understood at the time. Houses along the main street received their flushing-water from an overflow duct at the side of the main street, each house having its own sluice, implying rights of use at a particular hour of the day.⁶ The overflow from the main cistern of the frontier-fort at Housesteads⁷ was also used in the same way.

Thus, with the exception of the overflow water conveyed in ducts, the water-supply, on leaving the main reservoirs, was converted from a gravitational supply in conduits to a low-pressure supply in pipes. How high it would then rise, and what uses it could serve, depended upon the relation of the height of the reservoir to the consumer's outlet, and the bore of the pipes. The need for creating a reasonable head of water in the pipes no doubt dictated the location of the primary *castellum*, favoured by Vitruvius,⁸ on the town wall; and this explains the frequent association of Roman aqueducts in general with town walls.⁹ The earlier aqueducts of Rome itself had their associations with the Republican Wall.¹⁰ But when the supply was delivered at a low level, establishments needing a good head of water had recourse to their own methods of getting it. The main *Thermae* of Ostia have storage-tanks from which the water was lifted by a wheel to an upper-floor tank, whence an adequate supply at fair pressure was

¹ *Dig.* xliiii. 19, 1; 49, 2.

² *Frontinus*, 111, a post-Tiberian rescript.

³ *Mem. Amer. Acad. Rome*, i, pp. 59-61; see p. 306, below.

⁴ Platner-Ashby, *Top. Dict.* p. 524.

⁵ *Wroxeter Report II* (Soc. of Antiquaries of London), p. 2, pl. ii.

⁶ Cf. *CIL*. vi. 1261, the famous map of the Tusculan *aqua Crabra*, identified by Mommsen (*Zeitschrift*, xv. 307), with names, number of sluices, and hours; cf. De Montauzan, *op. cit.*, fig. 128.

⁷ *Arch. Ael.* Ser. 4, x. 96, pl. iii.

⁸ *Vitr.* viii. 6. 1, 3, 4.

⁹ Cf. Fréjus, Donnadicu, *Fréjus*, p. 179, figs. 44, 45. Mérida, *Arch. Journ.* lxxxvii, p. 107. Orange, *JRS.* xxiii, p. 153; Solin, *Forschungen in Salona*, i, 132.

¹⁰ *Vide infra*, pp. 84, 147-8; the Imperial wall, contrariwise, embodied the aqueducts, see Richmond, *City Wall of Imperial Rome*, pp. 63-4, 72-5.

obtainable: for at Ostia the supply arrived at low level under the streets. A similar method must have been adopted in most cases, as, for example, at Silchester.¹ It was, indeed, the principle universally applied in English country-houses during the last century, and still in vogue with the improvement of the hydraulic ram.

¹ *Archaeologia*, lv, 422-4.

PART TWO

THE ACTUAL REMAINS

I. AQUA APPIA

THE history of Aqua Appia is summarized by Frontinus:¹

'In the consulship of Marcus Valerius Maximus and Publius Decius Mus' (312 B.C.) 'thirty years after the beginning of the Samnite War, the Aqua Appia was brought into the City by the Censor Appius Claudius Crassus, later called Caecus, who also had charge of the construction² of Via Appia from Porta Capena to Capua. His fellow-censor was Gaius Plautius, called Venox for discovering the veins of this supply;³ but this man resigned after eighteen months,⁴ deceived by Appius pretending he would do the same: so the honour of giving his name to the aqueduct fell to Appius alone, who is⁵ said to have extended his censorship by many subterfuges, until he had completed both road and aqueduct.⁶ The head-source of Aqua Appia is on the estate of Lucullus,⁷ on Via Praenestina⁸ between the seventh and eighth milestones, 780 paces to the left along a by-road. From its head to Salinae, a spot near Porta Trigemina, its channel is 11,190 paces long, of which 11,130 paces run underground, and 60 paces of substructure and arches above ground near Porta Capena.

'At Spes Vetus, on the boundary between the Horti Torquatiani and Epaphroditiani⁹ a branch of the Augusta,¹⁰ added by Augustus as a supplementary supply. . . . This branch has its source near the sixth milestone on Via Praenestina, 980 paces to the left along a by-road, near the Via Collatina. Its channel runs underground for 6,380 paces to the point called Ad Gemellos' (the Twins, i.e. the junction of two aqueducts). 'The Distribution of Aqua Appia begins at the foot of the Clivus Publicius, near Porta Trigemina, at the place called Salinae.'¹¹

¹ Frontinus, 5.

² The Loeb translation gives 'paving', an inadequate rendering of *munīendam*; Herschel's original translation is, in this case, better than Bennett's revision.

³ Cf. CIL. xi. 1827 = 12, p. 192, No. x. *Cens. Ap. Claudius. C. f. Ap. n. Caecus, C. Plautius C. f. C. n. qui in hoc honore Venox appellatus est.*

⁴ This was the regular term.

⁵ Cf. Livy, ix. 29. 6.

⁶ Cf. Eutrop. ii. 9. *Eo tempore Appius Claudius censor aquam Claudiam [sic] induxit et viam Appiam stravit.* Also, Cicero, *pro Cael.* 34.

⁷ We do not know anything of this estate from literature: the springs of the Virgo were also included in it.

⁸ Lanciani, 35 : 247 ff., proposes to read *Collatina* (*infra*, p. 51).

⁹ Lanciani's conjecture: *et . . . norum* appears in the Monte Cassino MS. There is a good deal to be said for Carcopino's conjecture *Tauriani* (*Basilique Pythagoricienne*, 67-74). He points out that the Horti Pallantiani and Epaphroditiani were not formed until after the death of Statilius Taurus, in A.D. 53, and that they may therefore well have been included in the Horti Tauriani, which could be extended as far as the *basilica* just outside Porta Maggiore. See p. 13 for discussion.

¹⁰ *Ramus Augustae*: Care must be taken not to confuse it with the Fons Augustae of Aqua Marcia, or with Aqua Alsietina, also called Augusta.

¹¹ Cf. 22. 'Neither Virgo nor Appia nor Alsietina has a receiving reservoir or catch-basin . . . The conduit of Appia, running along the base of the Caelian and Aventine, emerges, as we have said above, at the foot of the Clivus Publicius'.

Frontinus refers to repairs in another context.

'One hundred and twenty-seven years later, in the six hundred and eighth year from the founding of the City, in the consulship of Servius Sulpicius Galba and Lucius Aurelius Cotta,¹ when the conduits of Aquae Appia and Anio' (Vetus) 'had become leaky through age, and were being tapped by private folk, the Senate commissioned Marcius, then *praetor urbanus*, to repair the conduits and assert legal possession of them.'²

Still later, he points out its low level.³ 'There follow Aqua Virgo, and then the Appia. These, brought from land near the City, could not rise so high.' The intake⁴ indeed was '50 feet underground.'

The Appia also shared in the restorations of 33 B.C.⁵ and of 11-4 B.C.;⁶ and no doubt the *ramus Augustae* was added to it during the latter.

The researches of Frontinus into the output of the aqueduct elicited these facts.⁷

'In the records Appia is credited with 841 *quinariae*. A gauging of this aqueduct could not be made at the intake, since there it consists of two channels. But at the Twins, below Spes Vetus, where it joins with the branch of the Augusta, I found a depth of water of 5 feet, and a width of $1\frac{3}{4}$ feet, making an area of $8\frac{3}{4}$ square feet, or twenty-two 100-pipes plus a 40-pipe, which makes 1,825 *quinariae*,⁸ 984 *quinariae* more than the records have it. It was delivering 704 *quinariae*, 137 *quinariae* less than credited in the records, or 1,121 *quinariae* less than given by the gauging at the Twins. A considerable amount of this, however, is lost owing to the faultiness of the conduit; for it is deeply buried and does not show its leaks clearly: yet their presence is plainly indicated by the fact that in most parts of the City is encountered the excellent water which leaks from that aqueduct. But we also detected some illicit pipes within the City. Outside the City the conduit suffers no depredation because of its low level, which is 50 feet underground at the intake.'

After Frontinus no one mentions the Aqua Appia, unless we identify with it the *aqua subtus montem Aventinum currens* of the Einsiedeln Itinerary.⁹ If so, we approach the *ecclesia Graecorum* (S. Maria in Cosmedin) and the words *et currit usque ad ripam*, applied to the *Forma Iobia*,¹⁰ would really apply to Aqua Appia.

¹ 144 B.C. Frontinus' rendering puts the date of the foundation of Rome, in this case, as in others, two years too early.

² Ibid., 7.

³ Ibid., 18.

⁴ Ibid., 65.

⁵ Ibid., 9.

⁶ *Mon. Anc.* iv. 11, 12; *CIL.* vi. 1245.

⁷ *Frontinus*, 65.

⁸ Equal to 75,737 cu.m. in 24 hours, on Di Fenizio's calculation; see p. 30.

⁹ 13, 8; *Mon. Linc.* i. 512, *Diss. Acc. Pont.* 2. ix. 419.

¹⁰ *Eins.* 13, 22. The *Appia Tucia* (Corvisieri in Buonarroti, 1870, *passim*; Lanciani, 42:254) is a ghost-word, the correct reading being *Iocia*, for *Iovia* (see *infra*, p. 91). The medieval *Rivus Appiae* is the Almo, as in the cartulary of S. Giovanni a Porta Latina, of Boniface VIII (Crescimbeni, *Istoria di S. Giovanni a Porta Latina*, 215; Tomassetti, *Campagna Romana*, ii. 40).

THE springs of Aqua Appia have never been satisfactorily identified;¹ Lanciani, reading *Collatina* for *Praenestina*, would follow Parker² and Nibby³ in locating them in the quarries of La Rustica, near Via Collatina. But these springs are incapable of giving the supply credited to the Appia; and since the depth at the intake was 50 feet (*c.* 16 m.), it is more likely that the springs are now dispersed underground. They were lower than those of the Virgo, at 24 m. above sea-level, and thus the ground-level at the intake must have been something less than 40 m. above the sea.

Among other attempts to find the springs may be noted that of Steuchius, who suggests *dextrorsus* for *sinistrorsus* in the fifth chapter of Frontinus, and identifies them with springs at the foot of Rocca Cenci.⁴ More recently, Luini⁵ has maintained that the springs still feed the so-called Acqua di Mercurio,⁶ but without proof. He points out that the identification was proposed in 1667-9 by Urbano Davisì, General of the Jesuits, who reported on the subject to Clement IX.⁷

The springs of Aqua Augusta, the secondary branch, are to be sought, according to Lanciani, on the left of Via Praenestina, in the marshy district between the Fosso di Tor Bella Monaca and the Fosso di Tor Angela, to the north of the Muraccio dell'Omo, which is just beyond the sixth mile. He thought that the by-road here represented the *deverticulum* mentioned by Frontinus, but the writer has never seen any traces of antiquity along it.⁸ Contours show that any springs used here would have lain between 38 and 28 m. above sea-level. Thus it seems almost impossible that its channel could be the same as that found in 1912 near the Porta Maggiore, as was believed.⁹

Hülsen¹⁰ marks the *specus* of the Augusta running south-west from the Nymphaeum of the Horti Liciniani, across the Via di Porta Maggiore, under the houses on the west side of the Via Pietro Micca. But there is no indication of it in Lanciani's *Forma Urbis*, nor does Hülsen describe it. Again, no trace of it was found in making the new garage of the S.P.A., when the *Monumentum Aureliorum* was discovered. In fact, no trace of the *specus* of either the Appia or the Augusta has ever been found between

¹ PBSR. i. 143.

² *Aqueducts*, 5, pl. i and ii and *Diagrams*, i-iv. One of his photographs of these quarries (which are now considerably altered) is repeated by Herschel, 145, 'Sources of Appia', with the note 'the incrustations caused by the excessively hard water of these springs are plainly to be seen'. But the Aqua Virgo, which rises not far off, is anything but hard; and that the Aqua Appia can have had much calcareous matter in it is difficult to believe—if not impossible.

³ *Analisi*, i. 124.

⁴ *De Aqua Virgine in Urbem revocanda*. Cf. Cassio, 1. 23, 24, who does not appear to have seen any traces of them.

⁵ *Bull. Com.*, 1903, 243; 1904, 215.

⁶ Lanciani, 9: 221.

⁷ Previously printed by Schreiber, *Sächs. Ber.*, 1885, 119.

⁸ PBSR, i. 1645; cf. *Bull. Com.*, 1903, 242.

⁹ Gatti in *Bull. Com.*, 1912, 232, 233; *infra*, p. 82.

¹⁰ *Forma Urbis*, I, II.

the springs and the City, or in the neighbourhood of Spes Vetus.¹ Parker² thought he had found the Appia at Porta Capena; but as Lanciani pointed out, the Appia did not actually run on top of or in contact with the Republican wall, but lay at no great distance from it (*proximum portam Capenam*). Lanciani is, however, obscure when he goes on to observe that 'since the pavement of Via Appia must have passed over the subterranean *specus* of the aqueduct, it is clear that the Porta Capena was situated not at the bottom of the valley, but on the slopes of the Caelian, precisely where Parker found traces of it'. The facts are rather that the course of Via Appia, and our knowledge of the position of Porta Capena, suggest that the aqueduct was still running underground where Via Appia crossed it.

Authentic remains of the *specus* were, however, shown by a quarryman to Fabretti in 1677, in some tufa-quarries under the vineyard of one Benedetto Santori, which lay 'at the angle made by the road from the curved end of the Circus to the Porta Ostiensis (Porta S. Paolo) with another road leading to the left to the church of S. Balbina the martyr'.³ Fabretti gives a section of it, and a plan showing its relation to the other two channels. 'Quite recently', his account runs, 'another *specus*, lying hidden at a very low level, was shown me by a quarryman, who guided me, though I had to crawl with difficulty along the ground: but when I saw it, the novelty of finding something that I had long been seeking drove all feelings of weariness and fear of the place out of my body and mind. I discovered by comparison with the *specus* of the Marcia and Anio, which ran close by, that this was the lowest of all the aqueducts on the left bank of the Tiber: for it ran as much as 28 feet below the Anio Vetus' (he is referring to what he believed to be the Specus Octavianus: see p. 87) 'as far as I could calculate in so confined a place, after repeating my levelling through the quarry. . . . A strong argument may also be drawn from the fact that its measurements are identical with those assigned to the Appia by Frontinus (65). For although this *specus* differs as widely as possible in shape from all the rest, inasmuch as the sides become gradually wider apart; a peculiarity which I have observed in no other aqueduct, and which I think from what Frontinus says (9) to be due to the restoration by Agrippa of this and other aqueducts which were almost in ruins; yet if you go on about another seventy paces, you will find the sides straight, and parallel to one another, a foot and two thirds,

¹ See Lanciani, 36: 248, correcting his previous statement in *Bull. Com.*, 1874, 203.

² *Aqueducts*, 9, and *Diagrams*, pl. xviii, photos. 1138-42; *Archaeology of Rome, Suppl.* (London, 1876) pl. x; cf. *Bull. d. Inst.*, 1870, 235.

³ 39: 31 and pl. xxi (the section is copied by Lanciani, *Ruins and Excavations*, p. 48, fig. 30).

as Frontinus says, apart; and the height is five and a half feet without calculating the *signinum* lining.'

Lanciani saw the *specus* in January 1876, and followed it for over 100 m., finding that Fabretti's description required no revision. The part seen by Fabretti was a *specus* cut in the tufa, $5\frac{1}{2}$ feet wide and high, with a vaulted roof having a chord of half a foot; its sides were lined with three courses of *peperino* blocks, the two lower courses being 1 foot 4 inches apart, and the upper 2 feet 10 inches. After 70 paces the *specus* became rectangular, 6 feet high and 1 foot 9 inches wide.¹ The hydraulic cement at the bottom was half a foot thick; the deposit very thick and dark, spongy on the surface and like stone below.

Lanciani also saw, as Fabretti did not, square *putei* with foot-holds spaced at regular intervals in the roof. The remains were being destroyed by quarrymen, who had removed much of the six-foot side and vault, but since 1880 the *specus* has been covered and nothing is now to be seen. It was found again in 1881 in constructing the new Viale di Porta S. Paolo.² The two other channels crossing it at an angle, which Fabretti assigned to the Anio Vetus and the Marcia, were simply ordinary drains or water-channels.³

Parker⁴ rediscovered the *specus* in a subterranean stone-quarry nearly under S. Saba, and describes the rectangular part of it; he also states that excavation in 1870 revealed, in an adjacent quarry, no less than five *specus*, some of them sloping steeply down, and carrying the water into the lowest of all, the Appia; while in 1875-6 the *specus* was more thoroughly examined and made accessible. The fact that the *specus* was everywhere deep below ground here suggests that the statement about arches near Porta Capena by Frontinus⁵ must be a mistake. He was perhaps confusing the arches near Porta Trigemina, presently to be noted.

To reach the terminal point of the aqueduct at the Salinae, below the Clivus Publicius, the channel must have turned sharply from south-east to north-west, tunnelling under the Aventine. But the various channels identified⁶ with its *specus* all lie outside the Republican Porta Trigemina, as Lanciani points out, and cannot be taken into consideration. They seem to be connected⁷ with the drainage of the Aventine.

¹ Lanciani, no doubt by misprint, gives the height as 8 feet; 6 feet would represent $5\frac{1}{2}$ feet, given by Fabretti, plus $\frac{1}{2}$ foot for the cement layer.

² *Forma Urbis*, 41 (unluckily it is not otherwise described). *Bull. Com.*, 1891, 213 fin., 'the building (the Domus Cornificia) is crossed diagonally at a considerable depth by the *specus* of the Appia'.

³ So Lanciani, 53; 265 fin. (cf. pl. i. 6).

⁴ *Aqueducts*, 9; *Diagrams*, iii. xix.

⁵ Frontinus, 5.

⁶ e.g. by Parker, *Aqueducts*, 10, pl. iv; cf. Lanciani, 38 : 250.

⁷ Cf. Descemet, *Fouilles exécutées à S. Sabina*, Paris, 1863.

The Arch of Lentulus and Crispinus, erected by the consuls of A.D. 2,¹ formed, according to Flavio Biondo,² one of a series, and was situated below the Aventine, near the Pons Aemilius. It was destroyed in his own day. This Arch was thought by Lanciani³ to have belonged to a branch of the Marcia, chiefly because its inscription is like that of the Arch of Dolabella and Silanus. But the latter Arch is eight years later, and it seems unlikely that work on an unimportant branch of the Marcia should have proceeded so slowly that the Arch at the end of the branch had already been finished so long before. Again, both Arches bear the additional phrase *idemque probaverunt*, as though the work in question had in each case been completed. Thus it seems better to refer them to two separate conduits, each forming part of Augustus' general restoration of the City water-supply; and since the arch of Lentulus and Crispinus, according to all our authorities, stood *imo Publicii clivo*, the terminal point of the Appia, it should be referred to this aqueduct. It should be added that Lanciani⁴ would associate with this Arch two dedications, to Germanicus and the younger Drusus, just as he associates the two dedications to Gaius and Lucius Caesar with the Arch of Augustus. These were set up to the dead princes by the *plebs*,⁵ probably under their statues, which were apparently found near the Arch. They cannot have been added before A.D. 23.

The level of the Appia at its terminal point is estimated at 15.00 m. above sea-level. Its source is lower than that of Aqua Virga at 24 m. This gives a fall of not more than 8 m. in 16.617 km. (11,190 paces), or about 0.5‰.

II. ANIO VETUS

FRONTINUS describes the Anio Vetus as follows:

'Forty years after the Appia was introduced, in A.U.C. 481,⁶ Manius Curius Dentatus, Censor with Lucius Papirius Cursor,⁷ contracted to bring

¹ CIL. vi. 1385, *P(ublius) Lentulus Cn(aei) f(ilius) Scipio T(itus) Quinctius Crispinus Valerianus Co(n)s(ules) ex S(enatus) C(onsulto) faciundum curaverunt idemque probaverunt*.

² *Roma instaurata*, i. 20. 'Qua is mons Aventinus vergit ad pontes ubi nunc vetustissimos arcus ut in calcem decoquerentur dolentes vidimus a fundamentis excidi. Quos arcus fama fuit ex quibusdam indicantibus litteris apparebat Horatii Coclitis honori fuisse a maioribus excitatos.'

³ *Lanciani*, 100 : 312.

⁴ *Storia degli scavi*, iii. 39.

⁵ CIL. vi. 909, 910.

⁶ 273 B.C. according to the ordinary reckoning: but Frontinus is in error, here and elsewhere, by one year.

⁷ Frontinus is wrong, the colleague was Papirius Praetextatus, see *Fasti Cons.* (*Not. Scav.*, 1925, 376-81. i; cf. *Bull. Com.*, 1925, 280); [*Cens. Pap*]irius L. f. M. n. Praetext. in *Mag(istratu) m(ortuus) e(st)*. M'. Curius M'. f. M'. n. Dentatus. The mistake was not unnatural, for Praetextatus is otherwise unknown (unless Aul. Gell. *Noct. Att.* i. 23 refers to him); Mingazzini (*Not. Scav.*, loc. cit.) arbitrarily assigns the mistake to a late interpolation, but is right in pointing out that its correction removes the difficulty of assuming the joint

into the City the Anio aqueduct (now called Anio Vetus), out of the booty¹ captured from Pyrrhus. This was in the second consulship of Spurius Carvilius and Lucius Papirius. After two years,² the question of completing the aqueduct was discussed in the Senate on the motion of . . ., as praetor. Then Curius, who had let the contract, and Fulvius Flaccus, were appointed by decree of the Senate as joint commissioners to bring in the water. Five days after his appointment, Curius died, and the credit of the finished work belongs to Flaccus. The head of the Anio Vetus is above Tivoli, twenty miles beyond Porta³ . . ., where it gives part of its water to supply the Tiburtines. Its conduit has a length, owing to the necessities of levelling, of 43,000 paces: the channel runs underground for 42,779 paces, and there are supporting-walls for 221 paces.⁴

'Sixth in the scale of levels comes the Anio Vetus, which, like the Marcia, would supply even the higher points in the City, if it were raised on substructure or arches where the valleys and depressions demand this.'⁵

'The Anio Vetus has its own settling-tank on this side of the fourth milestone (on the Latin way), passes on below the * * *, which crosses through the arches from the Via Latina to the Labicana. On this side of the second milestone, it gives part of its water to the *specus* called Octavianus, running to the Horti Asiniani in the district of Via Nova, whence it is distributed throughout that zone. The main conduit, passing behind Spes Vetus, is distributed throughout the City inside the Esquiline Gate, in deep conduits.'⁶

In 144-140 B.C. the Anio Vetus was repaired, with the Appia, by Q. Marcius Rex.⁷ Agrippa did repairs in 33 B.C.,⁸ and Augustus in 11-4 B.C. Augustus erected the only *cippi* recorded from this aqueduct, and may also be taken to have constructed the branch known as the *specus Octavianus*.

In A.D. 97-8, Frontinus took measures to improve the supply which he records as follows:—

tenure of censorship and consulship (De Ruggiero, *Diz. epigr.*, s.v. *Censor*) or a confusion of names (De Boor, *Fasti censorii*, ii. 79; Münzer, *Röm. Adelsfamilien*, 110; Beloch, *Röm. Gesch.*, 85, 628, 629). After Curius' death, a fresh pair of censors was appointed in 269 B.C., for the 34th *lustrum* (Lanciani, 44 : 256); for Curius, owing to Papirius' death, had no doubt been unable to complete the *lustratio*. Thus, no less than six consulates separate *lustra* 33 and 34.

¹ Cf. *De vir. illustr.* 33, 9, *Aquam Aniensem de manubiis hostium in urbem inductam*. Statius, *Silv.* i. 5. 25 may refer to Anio Novus, cf. p. 253, n. 2.

² Mommsen notes (*Staatsrecht*, ii. 668) that this is an exceptional extension, like that created by Appius Claudius (*Frontinus*, 5) and accorded to Marcius Rex (*Frontinus*, 7). The normal term was eighteen months (*Staatsrecht*, ii. 342, n. 2, 349, n. 1; *Livy*, ix. 33).

³ The MS. reads *Portam . . . RRA . . . nam*. Various conjectures have been made, but Lanciani's is perhaps the best (Lanciani, 46 : 258). There was a village called Barana, east of Tivoli (Nicodemi, *Storia di Tivoli*, i. 1. 7); Lanciani would therefore read *Baranam*, making the gate correspond to Porta S. Giovanni, on the road leading to Valle degli Arci, where the Tivoli branch must have diverged.

⁴ *Frontinus*, 6.

⁵ *Ibid.*, 18.

⁶ *Ibid.*, 21. The first sentence of this passage is corrupt. The MS. reads *Anio vetus citra quartum miliarium intra* novi equia* uia latina in lavicanam inter arcus traicit, et ipse piscinam habet*. It is not clear what crossed from Via Latina to Via Labicana, though it is true that the Anio Vetus left the former whereabouts. Lanciani, 49 : 261 calls attention to the existence of a *deverticulum* to Via Labicana from this point. Thus, there might be the road to consider, in some such version as *intra novum et viam quae a via latina, &c.* We cannot now restore the sense. See p. 79 for further topographical details.

⁷ *Frontinus*, 7; Plin., *N.H.* xxxvi. 121.

⁸ *Frontinus*, 9.

'The Anio Vetus is credited in the Records with 1,541 *quinariae*. At the head I found 4,398 *quinariae*,¹ excluding the quantity diverted into the special Tivoli conduit, 2,857 *quinariae* more than recorded.

'Two hundred and sixty-two *quinariae* were distributed before the aqueduct reached its settling-tank. The quantity flowing into the tank through gauges placed there was 2,362 *quinariae*; thus 1,774 *quinariae* were lost between the head and the tank. Beyond the tank 1,348 *quinariae* were distributed; more than we have stated to be the measure at the source according to the Records by 69 *quinariae*; less than we have set down as received into the conduit leaving the tank by 1,014 *quinariae*. The total lost between source and tank, and below the tank, amounted to 2,788 *quinariae*, which I should have suspected to result from bad measurement, had I not discovered where it was diverted.²

'The two Anios are less clear because drawn from the river, and are often clouded even in fine weather; for the Anio, though flowing from a very clear lake, still carries away muddy matter from its loose, crumbling banks before reaching the conduits. This inconvenience affects it during rain, not only in winter and spring but also in summer, the season when pure water is the more welcome and the more demanded. One of these two aqueducts, the Anio Vetus, running below most of the others, keeps this inconvenience to itself. But the Anio Novus used to contaminate the rest, because it runs at the highest level and is among the most abundant, and so helps to make up the shortage of the others. Actually, however, lack of skill on the part of the water-staff diverted it into other conduits more often than augmentation demanded; thus, it defiled even the adequate supplies, notably the Claudia, which flowed independently for miles, and only lost its quality, until recently, by mixing with the Anio in Rome. So far was the admixture from benefiting the supplies thus aided, that most came to be drawn upon unsuitably by careless allocation. Thus, we discovered even the Marcia, so delightful for sparkle and coldness, serving baths, fulleries, and purposes too vile to mention.

'It was therefore determined to separate all the supplies, allotting them so that, firstly, the whole of the Marcia should serve for drinking, while the rest should then be assigned to suitable purposes according to their special qualities; for example, the Anio Vetus for several reasons (the farther downstream a water is drawn, the less wholesome it is) should be used for watering gardens and for the meaner uses of the City itself.'³

Two statements by Frontinus raise serious difficulties. The site of the intake is not 20 miles above Tivoli. Lanciani⁴ accepted the site fixed by Canina,⁵ 850 m. above S. Cosimato, at the mouth of the Torrente

¹ As we have pointed out above (p. 30), this is the figure we must take as that which was the result of the improvements introduced by Frontinus. It amounts to 182,517 cubic metres (40,153,740 gallons) in 24 hours, on Di Fenizio's reckoning.

² *Frontinus*, 66.

³ *Ibid.*, 90-2.

⁴ 44 : 256.

⁵ v. 140; vi. 141 (cf. Cassio, i. 101); Canina mistook remains of the Anio Novus still extant here for a dam. In the gorge of S. Cosimato his supposed *specus* was really a mill-race (referred to as drain in *Bulder*, 90); as the writer saw it, before 1908, it was 1.90 m. high and 0.82 m. wide at the bottom, narrowing gradually to 0.30 m. at the top. It was cut in the rock, and its upper end was 0.50 m. above the river-level, so that the river when in flood actually ran through it. It wound slightly, but its main direction was south-east, and it passed through the rock under the pier of the modern bridge over the gorge. Two similar channels were visible, before the reservoir was constructed to supply the turbines

Fiumicino; but the actual intake was discovered about a mile farther downstream, a little way above the bridge at Vicovaro. Yet Vicovaro, the ancient Varia, is only 8 miles from Tibur by Via Valeria, and the course of the aqueduct cannot have been much longer.¹ Thus, the distance recorded by Frontinus does not accord with the facts.

Secondly, and apart from the discrepancy just discussed, there is a discrepancy between the total figure given by Frontinus (43,000 paces) and the figure calculated by Lanciani from the Augustan *cippi*. The *cippi* recorded² are:

	Original Number	Interval in feet	In situ or not	Place of Publication
a.	932	240	No	<i>CIL.</i> vi. 31558 <i>h</i> = xiv. 4079.
b.	901	320	No	<i>CIL.</i> vi. 31558 <i>g</i> = 1243 <i>e</i> = xiv. 4080.
c.	733	240	No	Unpublished.
d.	669	240	No	<i>CIL.</i> vi. 31570 <i>b</i> = 1243 <i>d</i> = xiv. 4084; <i>Bull. d. Inst.</i> , 1861, 39.
e.	659	240	No	<i>CIL.</i> vi. 31570 <i>a</i> = 1243 <i>c</i> = xiv. 4083; <i>Bull. d. Inst.</i> , cit.
f.	645	240	Yes	<i>EE.</i> ix. 969; <i>Bull. Com.</i> , 1899, 38.
g.	626	240	No	<i>EE.</i> ix. 968; <i>Bull. Com.</i> , cit.
h.	18	240	Yes	<i>CIL.</i> vi. 31558 <i>f</i> ; <i>Bull. Com.</i> , 1881, 12, no. 451.
i.	13	240	Yes	<i>CIL.</i> vi. 31558 <i>e</i> = <i>EE.</i> iv. 809; <i>Not. Scavi</i> , 1878, 167; <i>Bull. Com.</i> , 1878, 98, no. 13; Gori, <i>Archivio</i> , 1879, 249.
j.			Yes	<i>CIL.</i> vi. 31558 <i>d</i> ; <i>Bull. Com.</i> , 1885, 100, no. 1021.
k, L. ³	6 (two)	240	Yes	<i>CIL.</i> vi. 31558 <i>b</i> , <i>c</i> = 1243, <i>a</i> , <i>b</i> ; <i>Bull. d. Inst.</i> , 1861, 13; <i>Lanciani</i> , 50 : 262.
m. ⁴	4	230	No	<i>CIL.</i> vi. 31558 <i>a</i> = add. p. 847; <i>Bull. Com.</i> , 1874, 208. <i>Lanciani</i> , 51 : 263.

All the stones, except *h* and *i*, bear the inscription *Ani(o) Imp(erator) Caesar Divi F(ilius) Augustus ex s(enatus) c(onsulto)*.

Lanciani adopts, on the basis of 932 and 901,⁵ a standard interval of 240 feet, and thus reckons the course from Tivoli to Rome alone as 223,680 Roman feet (= 44,736 paces = 66.433 km.). We would add to this about 49,326 Roman feet (= 9,864 paces = 14.650 km.) for the distance from Tivoli to the intake, making a total of 54,600 feet, or 1,600 paces more than Frontinus' figure. But 932 and 901 may have been copied at some distance

of the Alessandro Volta generating-station below Castelmadama, one on the right bank below the upper mill, 1.05 m. wide, the other below it, 0.70 m. wide; and there was yet another under the upper mill.

¹ *Livellazione*, sect. iv, gives 14.65 km. from intake (iv. 17) to point iv. 10 (see p. 50 of text, where iv. 8 is a misprint). This is equal to 9,864 Roman miles.

² Hülsen (*CIL.* vi. 3125) differs from Lanciani in assigning *h* and *i* to Anio Vetus as against the Marcia-Tepula-Iulia, because (*a*) they are of tufa, like all others of the AV. in Rome, while those of M-T-I are of travertine in Rome (outside the city, see pp. 123, 124, this rule is not absolute); and (*b*) may come from *putei*, whereas the M-T-I was here on arches. For *cippi d* and *e*, see below pp. 71-72.

³ So Hülsen (*CIL.*); Lanciani thinks the number was VII, as given by Herzog in *Bull. d. Inst.*, cit.; LVI is certainly wrong. See p. 84.

⁴ Hülsen thinks that the number was originally III, see p. 85.

⁵ As we shall see, no. 816 of the Marcia was found not far off, which may show that it was less tortuous (p. 112). See, however, editor's note on p. 58.

from their original position, even though 901 is said to have been found 'at Carciano' *in situ*; while the interval of 240 feet was not always observed.

It is possible, however, to calculate from two other *cippi*, 733, which is quite close to its original position, and 645, actually *in situ*. The distance from the former to Rome along the line of the aqueduct should have been 175,920 Roman feet (or 35,184 paces = 52.248 km.). The interval between the two would have been 21,120 Roman feet (or 4,224 paces = 6.273 km.); and this is indicated in our map by giving the aqueduct an extremely tortuous course, since a direct line between the two *cippi* is only about 2 km.

From 733 to 932 should have been a distance of 47,760 Roman feet, or 14.185 km., whereas our map shows only about 10.5 km.¹ From 645 to Rome should be 154,800 Roman feet, or 45.975 km., whereas the map shows it as only about 33 km.² Thus it is clear that while no sector of the aqueduct is so sinuous as that between 733 and 645, its true course must have been considerably less direct than has been shown in the map, for constructing which detailed information as to its exact course was to seek, especially where it runs underground for long stretches.

Finally, in the author's view, based upon his knowledge of the course and of the remains of its channel, it is impossible to suppose that between the erection of the *cippi* and the administration of Frontinus its course had been shortened to the extent of over 10,000 paces: a bold emendation to 53,000 paces would probably be best, assuming that the balance of error is partly due to the fact that the original position of *cippus* 932 and our point IV. 10 (in the quarry below Villa Braschi) do not correspond exactly.

[*Editor's note*: The last paragraph represents Dr. Ashby's opinion, based upon accepting 240 feet as the standard *cippus*-interval. But it is clear that the more tortuous the course the more *putei* and the more *cippi* would be needed, while the intervals would be less. Thus, the argument that 10,000 paces have really been lost is a dangerous one, and cannot stand when the principle that intervals could be less is admitted.]

(a) *From the source to Tivoli. Maps 5, 6, 7.*

At 35.50 m. upstream from the edge of the fountain, in the path on the left bank of the river, opposite the south-east end of the bridge to Vicovaro,³ could be seen in 1915⁴ a *specus* in grey

¹ *Livellazione*, section iv, shows the distance from IV. 10 to IV. 5 as only 8.940 km.: but there is another 1.5 km. to be added in the Valle della Mola de S. Gregorio, in which the shortening dates from the time of Hadrian.

² From IV. 4 (Ponte Taulella) to the Porta Maggiore (IV. 1) is shown as 32.620 km. on Profilo IV; and another 380 m. may fairly be added for the distance from *cippus* 645 to IV. 4. But the total estimated fall (3.51⁰/₁₀₀) should probably be reduced by something like 3⁰/₁₀₀, to allow for the greater length of the aqueduct: and certainly it was distributed far more heavily over the first portion. For from Ponte Pischero to Monte Falcone is only about 7 km. on the map, and the fall is 49.02 m.; while in the next 21 km. on to the point where the Marrana Mariana crosses the Naples railway, the fall is only 52.30 m. and in the next 5 only 8.25 m., though in these last it must have run fairly straight.

³ *Infra*, p. 201.

⁴ *Livellazione*, p. 64. I photographed it then, but it has since been buried with stones and earth.

Augustan concrete.¹ Only the top of the vault is visible, approximately 0.80 m. wide. The vault and side-walls are 0.45 m. thick. The direction, 40° W. of S., is at half a right angle from the direction of the stream: and the level IV. 17, taken on the intrados at the top of the vault is 264.24 m., no more than 0.50 m. above the present watershed of the Anio, so that the bottom of the channel would have been at least 1 m. below it. It seems indubitable that this represents the intake of the Anio Vetus; and the flat ground on the left bank of the river, now covered with vineyards, would provide a site for the basin whence the intake drew its supply.

The *specus* then continued underground, keeping near the river-bank, and appears again at Fosso le Giunte, a small tributary of the Anio, just beyond the railway station of Vicovaro. It is visible on both sides of the stream, some 10 m. from the river, running 20° S. of W. It is made of irregularly coursed hard tufa blocks, with flat inner faces, and wedge-shaped backs. Its pointed roof is formed of two inclined slabs of calcareous stone, each 0.58 to 0.60 m. long. This is a good sample of the original construction.

The level of the Anio, on 17 April 1915, was 261.26 m., only a little below the bottom of the *specus* (IV. 16), which was at 261.57 m. But it is clear that the *specus* ran underground originally and was not cut by a side-stream. Either, then, there was no stream here at all in ancient times, or else it ran at a considerably higher level.

The next point where the aqueduct appears is almost immediately south-west of the railway-bridge below Vicovaro, a little upstream of the tomb of Maenius Bassus² and near levelling-point (*caposaldo*) 917 of the Rome Municipal Electric Department (IV. 15; intrados, 262.32).

The *specus* lies about 10 m. above the river, and runs 15° E. of S. It was constructed on the 'cut and cover' principle, with its roof, at ground-level, made of two inclined blocks of porous local limestone, each 0.30 m. thick and 0.60 m. long. It is only 0.55 to 0.63 m. in width, and its sides are of the original ashlar, with a later lining of poor concrete. A length of about 20 m. is actually visible, and the roofing-blocks can be traced still farther along.³

¹ As Dr. Van Deman has established.

² *CIL.* xiv. 3665. Dessau's doubts as to whether the inscription was actually found where it has been re-erected are unnecessary, as a passage in Nibby's *Schede* (iv. 30) shows. In an account of an excursion to Vicovaro and Licenza, in May 1823, he writes as follows: 'It is a little after the 25th milestone (i.e. about 25½) that the following inscription is seen re-erected: it was found in the same place in June 1821: near this inscription are various fragments of marble and among them a kind of foot of an urn with flutings and the head of a Medusa.' Two *trapezophori*, decorated in this way, now flank the inscription in the monument as reconstructed, i.e. 'Sepolcro Basso' on the map.

³ *Builder*, 91.

In the valley of the small stream immediately opposite the tomb of Bassus, on the north edge of the Castelmadama map-sheet and a little before *caposaldo* 230 (I. 54), the impost is at 260.06 m. (IV. 14). There is deposit from the aqueduct at the stream, but no traces of a bridge. Below Colle Stefano, nearly a kilometre farther on, the author has seen a pile of stones, taken from the *specus* wall, of the refractory limestone of the region, like IV. 15; also roof-slabs of local tufa, slightly wedge-shaped, as at Fosso le Giunte.

No further traces are recorded again until the Alessandro Volta power-station, below Castelmadama. Here part of the channel, in dark-grey local tufa blocks, was destroyed when the pipes were laid (IV. 13). There was no trace of the bottom or of any cement lining to the *specus*. It was running 48° W. of S. and was 0.87 m. wide. Like all the remains so far described, except the actual intake, it is original. The intrados was levelled at 257.18 m.

The Anio Vetus does not appear in any of the valleys near Castelmadama, which the other aqueducts cross higher up by large bridges. It may also be noted that no trace appears of the original Marcia,¹ whose builders would have been almost equally anxious for concealment.

On Monte Papese, the *specus* appears on the north-east slopes, below the path which runs round them, and well above the river. These slopes are at first so steep that all the aqueducts run underground, and the first point at which the Anio Vetus reappears is about 50 m. NNW. of a gate across the path and 100 m. SSE. of *caposaldo* 225. The *specus* is of rough pseudo-concrete, and the roof of rough tufa blocks, all looking like original material re-used for the restoration of Q. Marcius Rex, in 143 B.C.² This piece was observed too late to be levelled.

The *specus* is visible again almost directly below *caposaldo* 225, a modern boundary-stone, inscribed C M (Castelmadama), close to a gate leading into cultivated land. Fifty metres farther on the intrados appears (IV. 12), constructed as elsewhere on the slopes. But just before a white house,³ to WSW. of Ponte S. Carlo on Via Valeria, the *specus* has been restored in concrete, with late brick-facing, buttresses, and a pointed roof to throw off moisture.

Unlike the Marcia and Claudia, which are frequently seen, this aqueduct keeps entirely underground in passing round the northern point of Monte Papese. The *specus* does not appear to have come to light during the works for the new dam and intake at Fiumerotto,⁴ but the author has seen the bottom of a *specus*

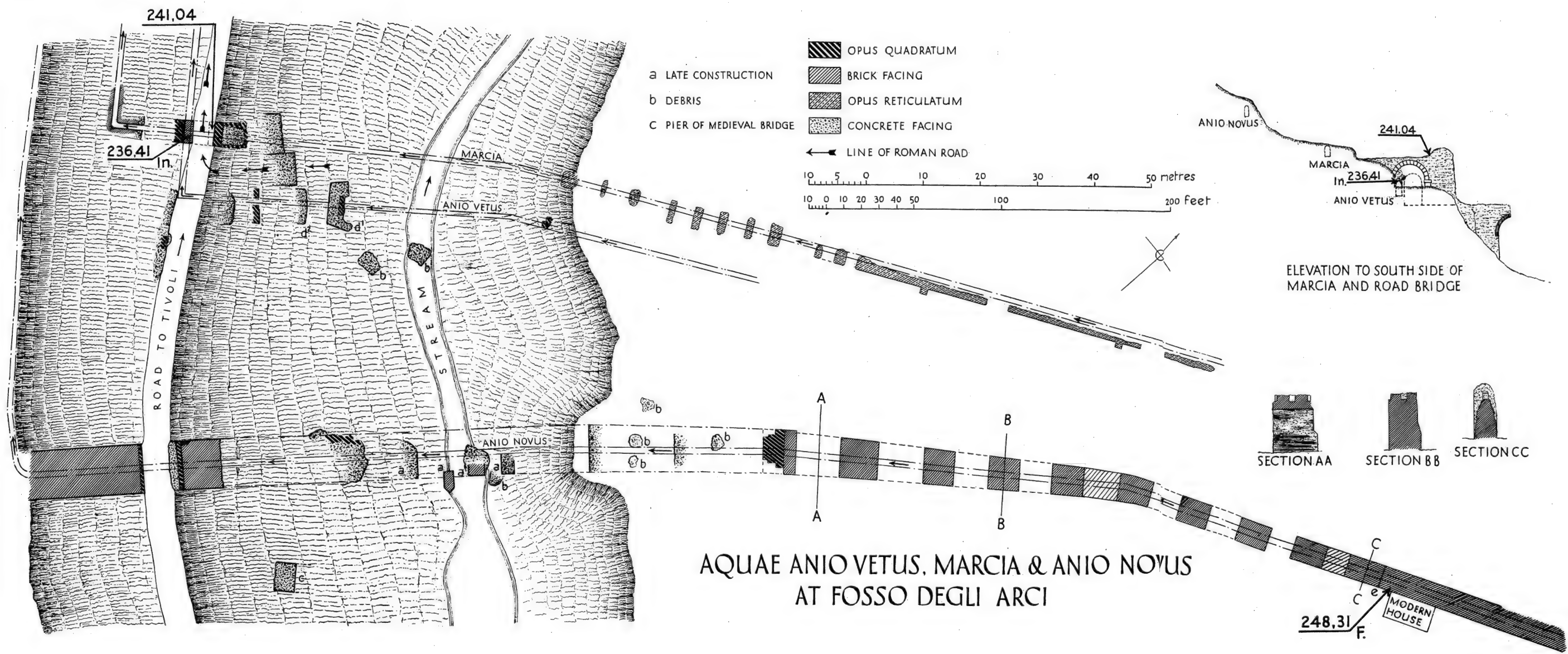
¹ See p. 106.

² As Dr. Van Deman suggests.

³ 'Casetta Bianca' in *Liivellazione*, iv, p. 58. Intrados at 254.22 m.

⁴ They are not marked in the map: the exact point is west of the extreme north bend of the river, opposite the small tunnel on the railway, N. of Casello 44,836.

FIG. 1



below II. 22 and III. 23, about 500 m. south-west of the dam, which must have been the Anio Vetus.

It is clear that the Anio Vetus, like the Marcia, continued to follow the curves of the Anio. There are no other remains of which a level could be taken.¹ A level (259.17 m.) was, however, taken on the top of an inspection-shaft, upstream of *caposaldo* 222 and ENE. of III. 21, which must belong to this aqueduct or to the Marcia.² The shaft has foot-holds and is rectangular, 1.20 m. long by 0.78 m. wide and is at least 5 m. deep (the crown of the *specus* was not visible): and, though cut through the tufa of the hill, is lined with concrete at the top, and closed with slabs of tufa. Its width would tally with that of the Anio Vetus *specus*. The aqueduct was at this point running south-west.

No further remains are to be found until Ponte degli Arci, which the Anio Vetus crossed almost immediately east of the Marcia (Pl. III *a*, Fig. 1). Very scanty remains of its bridge of ashlar encased in Augustan concrete³ appear in the west bank. Much of the Augustan concrete has been refaced later: pier *d*¹, fallen on its side, has good brick-facing, noted by the author before it became overgrown, while *d*², also fallen but in the line of the bridge, has brickwork too. There is another pier between this bridge and that of the Marcia, of late concrete with stone voussoirs in the arch, which Lanciani⁴ has attributed to the Anio Vetus; but Canina seems to be correct in giving it to the ancient road. Immediately on reaching the west bank of the stream the aqueduct turns north and follows the west edge of the modern road, where ashlar blocks from its *specus* may be seen; others were recently found running across the road itself, with later brick-faced concrete upon them. The *specus* soon passes under the arch of the Marcia to the north-west. It is roofed with two slabs of tufa, inclined to form a gable, 0.24 m. thick at the outer ends, and 0.12 m. at the inner ends; these may belong to the original construction. The sides of the *specus* are described by Lanciani as partly of original ashlar,⁵ and partly of Augustan *opus reticulatum*, but of the latter nothing is now visible. At the bottom are

¹ The remains mentioned in *Builder*, 111, belong to the Marcia.

² *Livellazione*, p. 57, 'Summit of a shaft upstream of Caposaldo 222'. For remains west of the summit of Colle Monitola, attributable to the Anio Vetus or the Marcia, but more probably to the latter, see III. 20. Also p. 108.

³ 'Passato l'arco dell'Aniene nuovo trovasi un pezzo dell'arco della Marcia (really the Anio Vetus, for he takes the Marcia to be the Claudia) che attraversava il fosso. Questo pezzo è opera reticolata al di fuori, ma interiormente di selci e tufo. La parte esteriore che formava il sesto dell'arco mostra d'essere stata di mattoni.' Revillas MSS. at British School. I do not know to which of these pieces he can be referring.

⁴ *Lanciani*, 45: 257; see his pl. iii. 2*b*.

⁵ *Ibid.* 47: 257; cf. his pl. iii. *a*, *b*, *d*, *e*. They are really of the small ashlar that is found in the Marcia along the slopes of the Monte Papese. Intrados here, 236.41 m.

smaller stones, slightly on the curve. The brick arch over the roofing-slabs is not earlier than the late first century A.D., and is connected with repairs to the Marcia.¹

Twenty metres along the bank from the Marcia bridge, the *specus* is visible for about 12 m., followed by a gap of 2.20 m. (too big for a *puteus*), full of deposit, which looks as though it had been made by water violently surging up or descending from the Marcia: the *specus* then begins again (IV. 11). The rise in level is due to restoration, and probably the *specus* had been lowered somewhat at the Marcia bridge. A little farther on a part of it is faced with Hadrianic brickwork.²

From the Ponte degli Arci to Tivoli no trace of the Anio Vetus is to be seen. The author learned, in June 1927, that until a few years ago an arched channel had been visible some 6 or 7 m. upstream from the road-bridge over Fosso Arcese. The floor of this came level with the bed of the stream. The structure had been blocked up by the walls which retain the banks of the stream on each side just above the road bridge. The parapet of this bridge (*caposaldo* 210) is about 4 m. above the bed of the stream, which would give the level as approximately 228.50 m. On this evidence, it becomes uncertain whether the Anio Vetus is in question, for the fall (7.50 m. in about 400, or 18.75%) would be unparalleled in this aqueduct, and is very much greater than the general fall in this part of its course.

Lanciani³ noted the discovery of a *specus*, in the cemetery of Tivoli (then limited to its present eastern part) 48 m. above the entrance-gate, on the left of the avenue leading to the Mausoleum. A sketch which he gives of it shows that it was subterranean. There is no doubt that this must have been the *specus* of the Anio Vetus, since the Aqua Marcia (III. 17) lies much farther back from the road: and to the same aqueduct may probably be referred the channels⁴ with tufa walls found in 1922, near the north-west end of the hemicycle in the new cemetery. Like the rest of the aqueducts, the Anio Vetus must have passed between the castle and the town; and the branch *ad Tiburtinorum usum*⁵ must have diverged thereabouts.⁶

¹ For the *specus* see Gmelin's view in *Dissertazione di Tivoli ed Albano* (engr. 1809, publ. 1816), tav. 6. The plates are still at the Regia Calcografia in Rome (*Cat.* No. 1238).

² This must be the *specus* that Revillas (*Vat. Lat.* 9024, 138v) saw in October 1737 and believed to be that of the Marcia. It was 3 feet wide and 9½ feet high, built of brick, with fine deposit.

³ *Sched. Vat.* 37, p. 30 (*d*), 48 m. a monte cancello Camp. Santo a sin. strada mausoleo.

⁴ I owe this information to Sig. Vincenzo Pacifici, who obtained it from the custodian of the cemetery.

⁵ *Frontinus*, 6.

⁶ Canina (v. 146) alludes to other substructures in ashlar towards Tivoli which I have not seen. Revillas (cod. cit. 140v) notes a *puteus* in the vineyard of Marchesa Corsini, which he assigns to the Marcia. But his attributions are unreliable.

In this sector Revillas¹ describes a *piscina*, which he attributes to the Anio Vetus. It lay in a narrow valley between road and river one and a half miles from Tivoli, and one wall served to support the road. This wall was 120 feet long, 18 high, and about 9 thick, with five arched niches, 15 feet high, 12 wide, and 5 deep, and pillars between them 9 feet 9 inches wide. There were sixteen channels in the wall, disposed in a horizontal line, $3\frac{1}{2}$ feet high and $1\frac{1}{2}$ feet wide. Some traces of the side wall existed on the west towards Tibur, but neither the length nor the width of the *piscina* could be obtained. At one end a *specus* ran in from the river; while the sixteen ducts appear to have communicated with a *specus* leading to Tibur, and perhaps to have served for filtering. Revillas cleared out one of them for about 8 feet, and prepared an illustration which would have made the description clearer: but this is unluckily wanting, and nothing is now to be seen on the spot, which was about 400 paces nearer Tivoli than the arch of the 'Marcia' (really Anio Vetus). The floor was 29 feet² above the river. The deposit resembled that of the Anio Vetus. The construction was of brick, with *opus reticulatum* in the upper part of the *piscina*. All the *specus* were of brick. Revillas thought that the actual intake from the river was 3 or 4 miles higher up, and that this was a filtering tank.

(b) *Tivoli to Ponte Lupo. Maps 4, 5.*

No certain piece of the Anio Vetus has ever been found in Tivoli. Revillas's³ attribution of the remains in the Via dell'Inversata to it is doubtful; while Raffaele del Re⁴ is certainly wrong, as will be seen, in identifying therewith various remains which must have belonged to one of the higher aqueducts, though his information in regard to the quarry is trustworthy. Nor are Canina's and Lanciani's attributions always correct, being made without the aid of levelling.

The author, however, was told on good authority that the *specus* of the Anio Vetus was found in an olive-yard, 10 m. above the Via Tiburtina, some 750 m. to the south of the tramway station of Tivoli (*caposaldo* 202) and 50 m. south of the villa of Sig. Lorenzo Magni. It was constructed entirely of concrete, and part of the outer wall is still visible, while in the drive of the next villa to the south the vault has been struck. West of the Villa Braschi just before reaching the quarry below, the whole of the vault may be seen, 10 m. back from the road and about 1.50 m. above it; it is round, and built of Augustan concrete.

¹ Cod. cit. 20 ff.

² The British School notes give 25 palms (about 19 feet).

³ Cod. cit. 29.

⁴ In his reprint (with notes) of the first five chapters of his ancestor Antonio del Re's work on Tivoli.

A branch was exposed here in the spring of 1925, going off westwards.¹ The *specus* was 80 cm. wide and 1 m. high to the pointed roof, which was 27 cm. high and very roughly formed, a lump of rock being left in the middle of it at one place. The fall was rapid, 0.70 m. in a length of 3.40 m.² or 205.88‰.

The main *specus*, cut in the rock, was levelled (IV. 10) in the quarry below Villa Braschi,³ a little farther down the Via Tiburtina. A good deal of it had been destroyed in quarrying, but it was in rough concrete, and exceptionally wide (1.30 m.).

South of this point, a considerable stretch of the Anio Vetus is visible, a little way above the high road, lying, as always, between it and the Via di Carciano. The stones of the earlier *specus* may be seen embedded in the exterior of the Augustan concrete. The width at first is 50 cm. with a pointed concrete top, formed on boards; it passes behind a single-chambered reservoir, with which it seems to have no connexion, and then increases to 0.74 m. wide, with a round top of concrete, again set on boards. Farther on still the *specus* is 0.69 m. wide, with a pointed concrete roof rising about 0.50 m. above its impost. At the beginning of this sector there is a blocked shaft on the east, and the *specus* south of this is lined with small stones and roofed, first with tiles laid flat, and then with concrete set on planks. There are several turns, one at right angles, where the *specus* is used as a tool shed, with a garden in front of it. To the south of the electric power line, by pylons 24 and 287, the exterior of the *specus* is faced with coarse *opus reticulatum* of local limestone.

Cassio⁴ rightly suspected that the Anio Vetus kept below the Strada di Carciano 'continuando (after Villa d'Este) sempre sotto la strada a destra, che appellasi di Carciano, dirimpetto all'Oratorio Suburbano della Madonna delle Grazie, o del P. Michele della Compagnia che fabricòlo, ed ivi compiva l'altro miglio, vedendosi nel oliveto inferiore all'altro del Seminario di quella città, scoperta dall'aratro e spezzato lo speco di tegole, la cui bocca ha la dirittura verso il Castello di S. Vittorino, dove nel tratto di IV miglia prolungarsi.'⁵ But he is quite wrong as to its further course, which he takes across Valle Pomata by the road bridge and down by S. Vittorino, Corcolle, and Passerano to

¹ Canina (v. 144) states that there are traces of a branch from the Anio Vetus to the Villa of Hadrian in the Fosso dell'Acqua Ferrata, that is, the Valle Pussiana, identified with the Vale of Tempe, north-east of the villa. The Acqua Ferrata lies ESE. of Villa Bulgarini and WSW. of *caposaldo* 195; so that whatever Canina saw—and he does not explain it so as to make it easy to find—can hardly have had to do with this branch, so much further north.

² These measurements were taken 4.00 m. from the point of divergence.

³ R. del Re, 116, notes that a fine piece of the aqueduct had recently been found in making the lime-kiln belonging to Signor Marius, which must refer to this quarry. ⁴ i. 37 ff.

⁵ He attributes this information to Don Andrea Jannilli, *inclinato a scoprire cose occulte fui da quando studiava nel seminario*.

Cavamonte, though the information which he gives on the subject of the remains of a reservoir and other ruins is useful for the general topography of the district.¹

Along the Strada di Carciano there are considerable traces of the Anio Vetus, and to this sector must have belonged *cippus* 901, seen in the district called Cassano (Smetius) or in the Villa Casiana (Ligorio) in the sixteenth century. Since we do not know the exact find-spot, it is impossible to tell whether 932, also copied in the sixteenth century but of uncertain provenience, belonged to this sector, or to that in Tivoli itself. A *cippus* of the Marcia,² numbered 816, was also found here, showing that the course of the Anio Vetus was, originally at least, considerably the less direct of the two.

The next trace of the channel occurs below the branch of the Marcia and *caposaldo* 199. Here, at a *puteus*, a level was taken where the downshaft enters the *specus*, the intrados coming at 215.27 m. The concrete is Augustan, faced with rough pieces of stone.

To the west, the aqueduct was supported by a battered wall of concrete faced in reticulate work of travertine blocks, measuring 0.20 by 0.10. It is followed by a rock-cutting for the *specus*, 1.75 m. wide. A level of 215.13 m. was taken on the intrados 'at another point south of Villa Salerno' which cannot be very far off, for the Villa Salerno is the small modern house south of the platform of the 'Villa of Brutus', built over the reservoir of which Lanciani gives a plan.³ It is probably on the south side of the little valley crossed by the bridge on which is *caposaldo* 199; for here, just before the chapel, there is section of *specus* in late brick-faced concrete with three buttresses, the supporting wall of which extends quite a long way down the hill.

The next two pieces are also late. The first has, once again, three buttresses, and may correspond with IV. 9 of the *Livellazione*; the second occurs just before reaching the little valley north of the quarry, in which is III. 14.

Still more late concrete is to be seen farther south, actually below the Grotte Sconce,⁴ along the hill-side; and just south of the last group of thick bushes, the top of the vault is visible, 0.45 m. thick, with original voussoirs, covered by protective Augustan concrete. It is clear from the levels that the aqueduct must pass just above the polygonal wall, which from here is traceable below the road along the slope, its far end being the finest piece.⁵ Indeed,

¹ See what I have said in *PBSR.* iii. 132; *Att. Soc. Tiburt.* iii. 20 = *Via Tiburtina*, 34.

² The *specus* at the tomb is of the Marcia, *vide infra*, p. 113.

³ See his pl. i, fig. 8.

⁴ See fig. 31, p. 278.

⁵ See *PBSR.* iii. pl. xviii, fig. 36, for an illustration of this wall (repeated in *Att. Soc. Tiburt.* vii = *Via Tiburtina*, fig. 39).

it probably served for the aqueduct and not for the road. Level IV.9, 213.99 (on the intrados 'below Grotte Sconce') may well have been taken there. A *puteus* with a late brick side-wall may also be seen, and concrete of the aqueduct appears further along.

The *specus* is next seen at the bottom of the branch descending from the Claudia.¹ This is 150 m. from the Grotte Sconce going southward, just south of the Voltata delle Carrozze, a hemicycle constructed in 1750 by the Governor of Tivoli for carriages to turn.

Only the intrados of the *specus* of the Anio Vetus appears at 213.33 m. (IV. e), with a buttress projecting 0.85 m. Below the spring of the vault the walling is of concrete with three courses of brickwork. Some 50 m. farther south a polygonal, or very rough ashlar, wall may be seen below the aqueduct:² it is only two or three courses high and must have been a supporting or protecting wall. Fifty metres from the beginning of this wall, the *specus* is seen again, of concrete, with large stone voussoirs; the intrados is at 214.20 m., and must be higher than usual, owing to restoration, for it is 0.87 m. higher than the last level. A *puteus* leading into it measures 1.19 by 1.24 m. and is lined with brickwork not earlier than Aurelian. About 30 m. farther on, where the modern Acqua Marcia descends the hill towards the Campagna, the concrete roof of the *specus* appears once more.

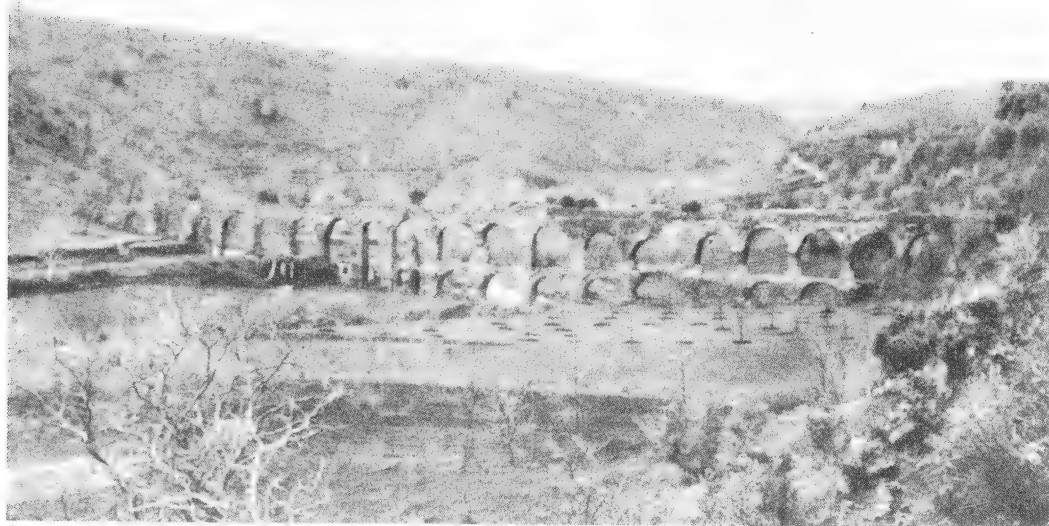
On the south side of the valley of the Ponte Arcinelli (I. 30), a channel descends from the Aqua Marcia to the Anio Vetus. Its intrados was levelled at 223.92 m. Two metres below it, there is a concrete wall faced with *opus reticulatum*, and this must be the outside wall at the top of the actual downshaft, for the *specus* of the aqueduct itself runs a good deal lower, reappearing to the south-west below the remains of a villa (IV. 8). The channel is of concrete, of which calcareous deposit is a component, faced with late *opus mixtum* and supported by two buttresses; the external work becomes 0.31 m. thicker below the impost. The protecting wall of rough blocks of stone continues along the hill-side; and then comes a piece of very late *specus*, 1.48 m. wide, with a round vault.

A little farther along, below the first gate into the olive-mills and on the Tivoli side of *caposaldo* 196, a piece of the *specus* has been made accessible by a flight of steps. It was originally cut in the rock, and was 1.30 m. wide. The original height is uncertain, but the side exhibits two courses of rough ashlar, probably original. Here also, probably because there was originally a *puteus*, the rock-cut roof becomes 0.70 m. higher for a short distance. But there has been a good deal of alteration and transformation after the aqueduct had fallen into disuse.

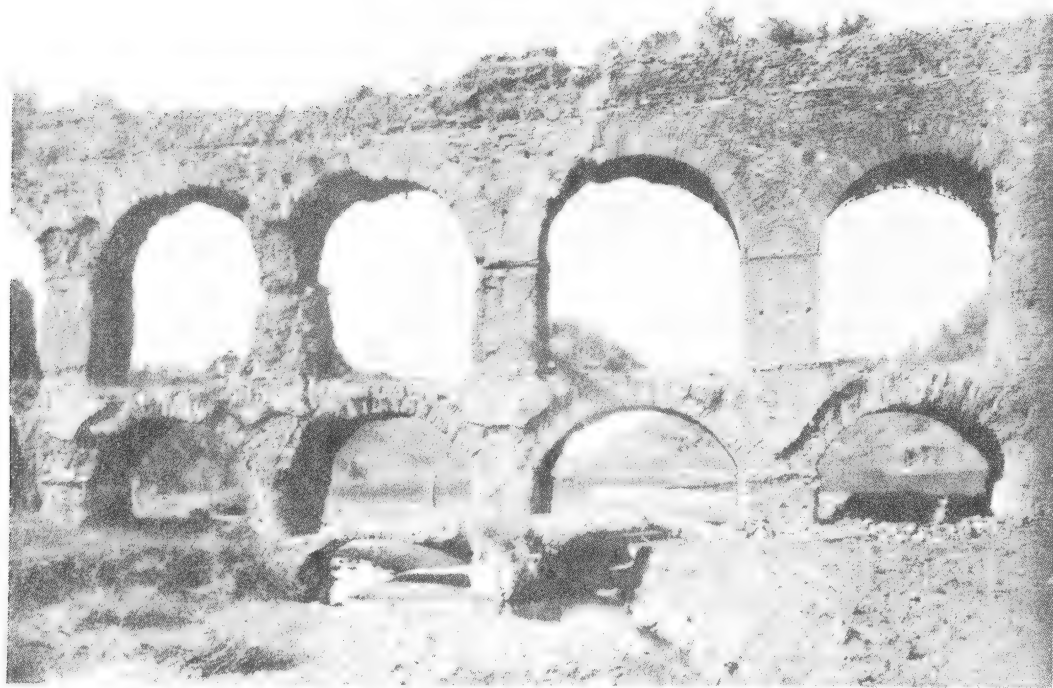
¹ *Livellazione*, p. 48, fig. 36.

² *Lanciani*, 47 : 259; *PBSR*. iii. 194.

PLATE I



a. ANIO VETUS: HADRIANIC LOOP, VALLE DELLA MOLA DI S. GREGORIO



b. ANIO VETUS: HADRIANIC LOOP, VALLE DELLA MOLA DI S. GREGORIO

The Anio Vetus now disappears underground for nearly a kilometre, to reappear after passing *caposaldo* 195,¹ before reaching the Grotta Papale, below a tree protected by a circular wall.² The roof is at first of blocks of tufa, set to form a gable; but a little farther south there is late concrete walling, faced with bad brickwork. After this, nothing more is to be seen until Fosso della Mola di S. Gregorio,³ a distance of 6.5 km. as the crow flies, where the *specus* emerges at a considerably lower level.

The Anio Vetus must indeed run deep underground in the neighbourhood of Gericomio.⁴ With reserve the author would attribute to it some indeterminate remains in Fosso delle Mandorle, north of Colle Fiore. On the north bank of this stream are fragments of a shapeless brick structure; below it, in the stream-bed, comes a rough structure of tufa blocks, with what look like foot-holes on the north; and in the stream itself is a circular ring of aqueduct-deposit, about 2 m. across, whose nature could only be learnt by excavation. The whole conglomeration suggests a *puteus*.

Rather less than a kilometre farther on, an undoubted *puteus*⁵ occurs, almost in a straight line between Casale and Torre dell'Acqua Raminga, on the hill which forms the north edge of the deep valley similarly named. It measures 1.00 by 1.20 m. and is open to a depth of about 5 m., but was originally much deeper. It is faced with small blocks of stone, mixed with pieces of aqueduct deposit. The fact that its shorter sides run south-west to south would indicate a westerly turn in the course of the aqueduct. The aqueduct must pass below the bed of Fosso dell'Acqua Raminga, but another *puteus*, badly preserved, is to be seen on the hill south of it, near a boundary stone with the initials G. L.,⁶ where the path leading south from the Torre is crossed by another path from the west, past the beginning of the small tributary stream south of the Torre. A third, better preserved, occurs a little to the south;⁷ it is 2.48 m. square, faced in bad *opus reticulatum*. The line of the aqueduct is almost due south at this point, and it followed more or less the same direction,

¹ The stone which once bore an inscription commemorating the painter, Ettore Roessler Franz. See p. 114 n. 3.

² There is a modern boundary stone with the letters OM, surmounted by a coronet.

³ Petronelli, in a letter of 18th Nov. 1740 states that he had been unable to find a *third* aqueduct in the Fosso dell'Acqua Raminga; but, as he had noted the Ponte S. Antonio, the small bridge of the Claudia, and the descending *specus* of the Marcia, this must be a mistake for 'fourth'.

⁴ Cassio, i. 37 (followed by Nibby, *Analisi*, i. 157) may be disregarded.

⁵ Noted by Petronelli (Letter i) as well as that of the Marcia higher up.

⁶ Noted in *Livellazione* 45, after *caposaldo* 140. *Caposaldo* 140 itself is wrongly marked, for the *ruderi* are well away to the east (see map). They consist of three concrete buttresses faced with *opus reticulatum* with stone quoins, which originally supported a circular structure, now almost entirely ruined. To the west is a villa-platform in *opus reticulatum*, extending over the end of the hill.

⁷ *Livellazione*, 45, *caposaldo* 139, 216.13 m.

keeping below ground in the small branch valley (covered by the words *Mola Brancaccio* on the map), until it reached the north-east edge of Fosso della Mola di S. Gregorio.

In this valley the Anio Vetus had three bridges, replacing each other successively. The oldest lay 12 or 14 m. below Ponte S. Pietro, where a small portion of its *specus* remains on the north-east bank of the stream, but was unnoticed¹ until June 1927, and therefore was not levelled. It runs 30° E. of S., and is roughly 1.23 m. wide; its sides are not preserved, and it can only be measured across the heavy deposit at the bottom, but the deposit at the top also remains, with a small portion of the vault and the east wall. The east wall is built of unshaped lumps of local limestone, without mortar, and may be attributed to the restoration by Q. Marcius Rex, rather than to the original construction, in which blocks or slabs are more likely to have been used.² Only a little way in, however, the channel has been completely blocked with cement, apparently because the little bridge crossing the stream had collapsed. Its level is about 172 m.³ The second bridge is marked by a new *specus*, 0.80 m. lower than the old. It runs 5° E. of S. and then turns to 20° E. of S. so as to cross the stream; it was built in ashlar of local limestone, the base slab being also of this material; it is 0.93 m. wide and has a slate-like, hard deposit on the bottom.

The third bridge is farther down-stream. Before reaching it, there are considerable remains of a *specus* in Augustan reticulate, on the left bank of the stream, with nine shafts. The uppermost of these shafts, 1.52 m. long by 0.68 m. wide, may be seen in the line of the disused mill-channel of the Mola di S. Gregorio, now destroyed, about 100 m. down-stream of Ponte S. Pietro, and about 10 m. away from the stream itself. Here was probably taken the level IV. 7 π (more correctly 5 π) according to which the bottom of the *specus*, no longer to be seen, was at 169.69 m. This would fit with the level of the earliest *specus*. The next measurement of the level of the bottom of the *specus*, in the third shaft,⁴ is 168.54 m., but this gives a height of only 1.24 m. and is probably too high. These shafts differ considerably both in dimensions (one is as large as 1.83 by 0.87 m.) and spacing.

The third bridge is the best example among all the aqueducts of the practice described by Frontinus⁵ that 'where a conduit is worn out, the aqueducts are carried on substructures or arches to

¹ The bank may only recently have been washed away so as to reveal it.

² As Dr. Van Deman has pointed out to the writer.

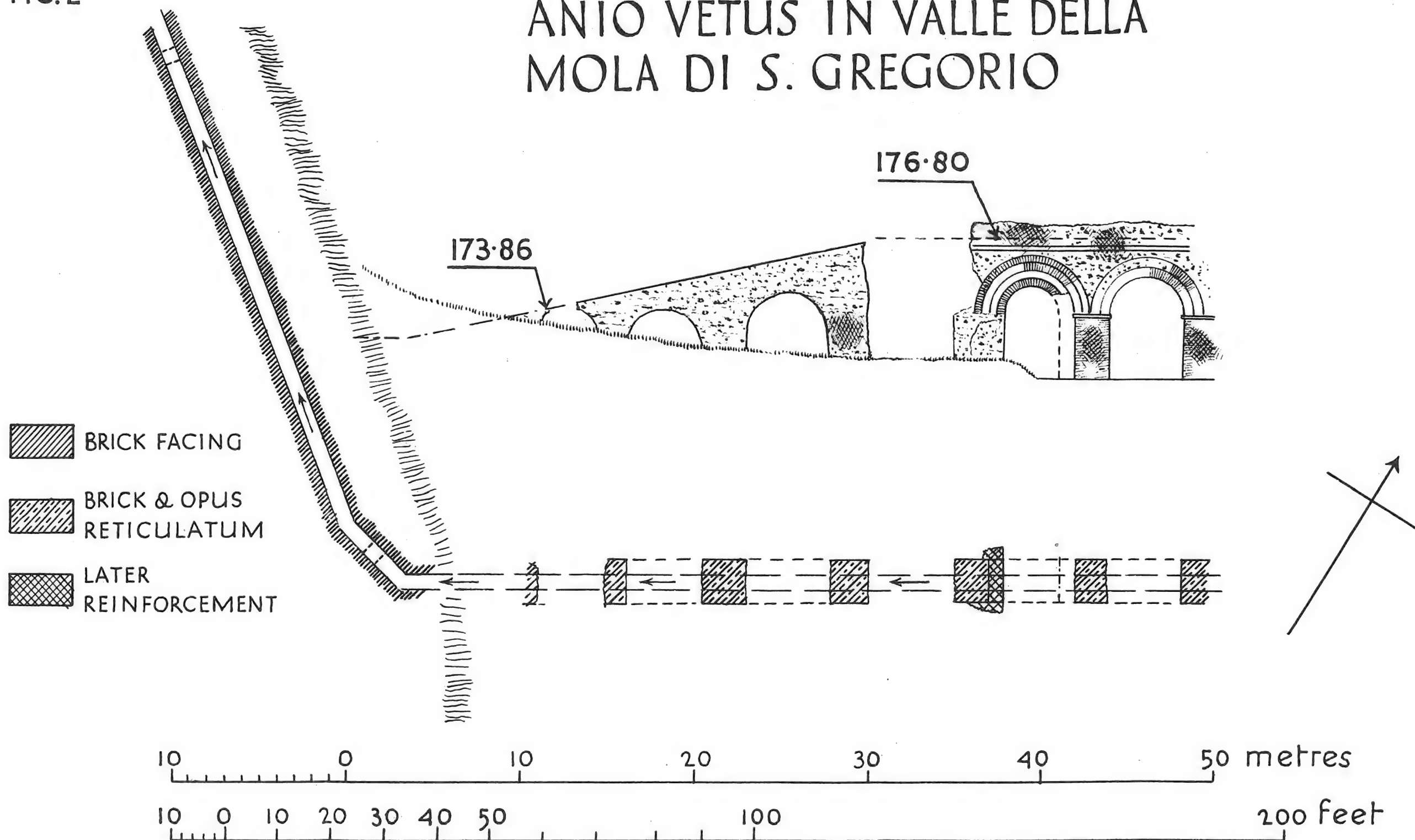
³ i.e. 2.28 m. above the level of the stream and 0.80 above the concrete at the bottom of the great arch of Ponte S. Pietro.

⁴ Cf. *Livellazione*, originally the 5th of the series.

⁵ *Frontinus*, 18.

FIG. 2

ANIO VETUS IN VALLE DELLA MOLA DI S. GREGORIO



shorten length, abandoning subterranean sectors in the valleys'; for Hadrian's engineers here shortened the aqueduct considerably by means of a bridge¹ (Pl. I *a, b*; Fig. 2), at a well-chosen point, just before the valley becomes wide. This bridge is drawn by Canina.² The *specus* comes straight on to it at the north end, without the usual right-angled turn; there are possible traces of a *puteus* to the west. The bridge is built entirely of concrete, originally faced with *opus reticulatum*, quoined with tufa in the piers and with brickwork in the *specus*. The arches have tile voussoirs, in double rings, and brick in the spandrels. Its total length is 155.50 m. and maximum height 24.50 m. Its twenty-two arches have an average span of 4 m., but those which cross the brook and the modern millstream, perhaps on the line of a former branch of the brook, have a span of 6.25 m.

The first and second arches climb down the bank. Then begins the arrangement in two tiers, in perfect order at first. The sixth upper arch, with an original springer, has been restored in late brickwork, with a triple ring of tiles instead of the original double ring. The next pier has been refaced, while upper arches seven to nine are restored in brickwork with a *specus* of *opus mixtum*. The springer of the ninth upper arch on the tenth pier (the eleventh was repaired in modern times), upper arches³ ten and eleven, together with arches twelve to eighteen (in one tier only) are original. Arch thirteen has been strengthened by a pier below its centre, supported by arched cross-stays, all faced in *opus mixtum*; and the pier of the seventeenth and eighteenth arches is reinforced in the same material. After arch eighteen, the gentle gradient of the bridge gives way to a rapid fall on arches nineteen to twenty-two, where the aqueduct goes to earth in a long tunnel. The nineteenth⁴ and twenty-second arches have collapsed.

The gentle fall⁵ is of 1.08 m. in 141.60 m., or 7.66‰; the rapid fall⁶ is of 4.09 m. in 25.00 m., or 163.5‰. The latter is the steepest gradient anywhere to be found on the aqueducts, and is matched only on the branch of the Claudia at S. Cosimato, which is also the work of Hadrian. It is explained by the fact that after

¹ Wrongly marked in the *Carta d'Italia* as 'Ponte dell'Antico Acquedotto Marcia'.

² vi. 145; his work is vitiated by the fact that he has not noticed the descent at the south-west end; cf. Lanciani, 47: 259.

³ Lanciani, *Wanderings in the Roman Campagna*, 190; *Builder*, fig. 11.

⁴ A brick from the impost-mould of Arch XIX bears a fragmentary crescent stamp, Q·OPPI: this is *CIL*. xv. 1345, 8, not more certainly identifiable, but dating from about A.D. 120. Cf. *CIL*. xv. 1346, 36, Q·OPPI·NATALIS found in 'ponte Arci', near Galliano; this may be the same bridge.

⁵ *Livellazione*, fig. 33, IV. 7b.

⁶ *Livellazione*, IV. 6g and f; allowance has to be made for 0.94 of deposit at f, to be added to 172.63, the level given at f, by the *Livellazione*: hence the calculation on p. 76.

the fall, with a turn almost at right angles, a long tunnel is entered.¹

The first part of the tunnel, running north-west along the hill-side, has recently been cleaned out and can be followed. It can then be traced by its shafts, for a total length of about 450 paces. Its *specus* is lined, as on the bridge, with *opus reticulatum* and brick-work: it is 0.97 m. wide and has a pointed roof. A rectangular shaft 0.90 m. broad soon occurs, followed by four² irregularly spaced, without relation to the normal 240 feet between the *cippi*. An intermediate shaft is smaller, and perhaps not ancient; the last shaft follows at a longer interval, 1.60 m. broad, lined with rough stonework, and 5.50 m. deep to water-level. After this comes a narrow cleft, leading towards Ponte Lupo, which this aqueduct no doubt followed, passing under the narrow ridge on which runs the Via di Poli.

North-west of the great bridge of the Aqua Marcia (Fig. 11), there is a large mass of concrete faced with *opus reticulatum*, running down to the water's edge. This encloses a shaft³ (172.00 m., IV. 5) faced in the same material, measuring 1.58 by 0.75 m., and provided with foot-holes, which is open now only to a depth of 5 m. It looks as if it communicated with a siphon under the stream, for the level of water in the stream here was 155.19 m., while the bottom of the *specus* at Ponte Taulella is at 155.61 m. (IV. 4); thus, a normal gallery below the stream is not to be envisaged. It has been suggested that it is just possible to suppose that the aqueduct ran over Ponte Lupo;⁴ but the levels of the Anio Vetus hereabouts will not allow it to clear the arches of the existing bridge, nor is any *specus* but that of the Marcia to be found.

(c) *Ponte Lupo to Capannelle. Maps 2, 3, 4.*

Immediately opposite the shaft on the right bank is another on the left, just below the modern path crossing Ponte Lupo; and farther on is a third, now filled almost to the top, giving the direction of the aqueduct as 30° N. of W. The sides of these are now lined with rough stonework, the original facing of *opus reticulatum* having disappeared. Both *putei* are high up on the slope of the deep and picturesque valley. Below the second, a tufa *cippus* (no. 733)⁵ was found not far from its original position by

¹ Editor's note: so Ashby. The real problem was to drop, in a short cut, the height which the water formerly lost in a long circuit. It was safer to do this in a short, rapid descent than in a long one during which the waters gathered momentum.


² The first four shafts were known to Petroncelli, as two of his letters show. Cassio (*op. cit.* i. 107) notes a shaft 'nella selva cedua del principe di quel territorio' (i.e. San Gregorio); this may be one of these.

³ Noted by Revillas, *Cod. vat. lat.* 9024, 60.

⁴ *Livellazione*, pp. 74-5.

⁵ The stone is 1.20 m. high, 0.46 m. wide, and 0.25 m. thick; the prepared surface is 0.65 high and the rest was buried. The first line is 0.05 high, the second 0.06 m., the third 0.045 m. and the fourth 0.04 m.

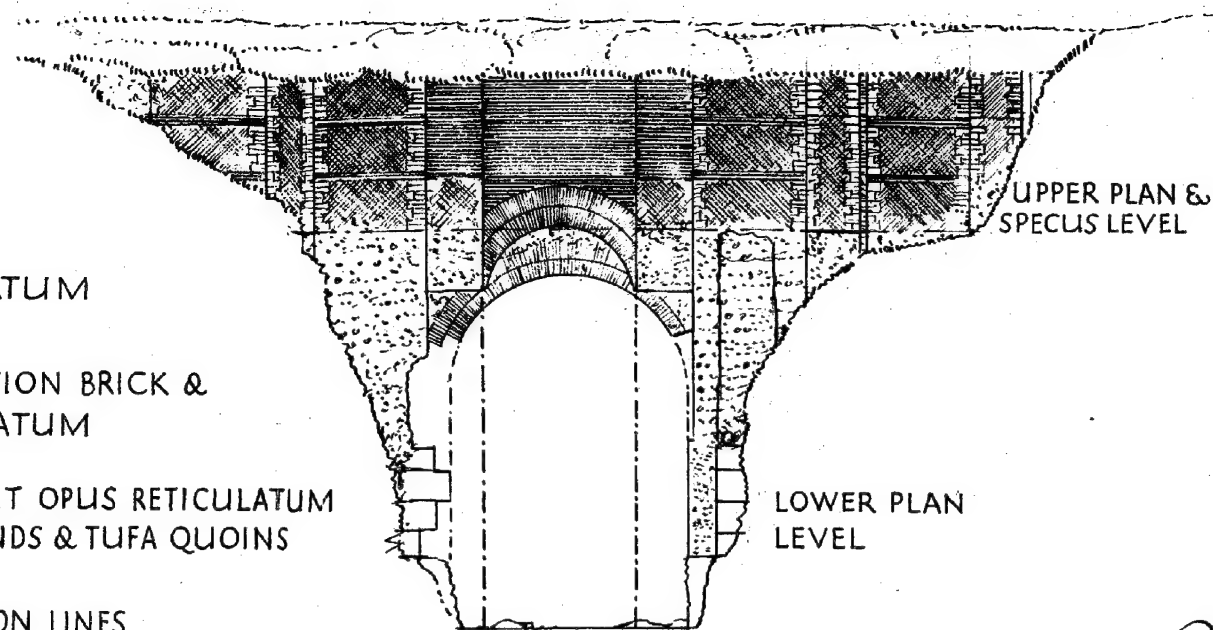
FIG. 3
ANIO VETUS
AT PONTE
TAULELLA

 OPUS QUADRATUM

 1ST. CONSTRUCTION BRICK &
OPUS RETICULATUM

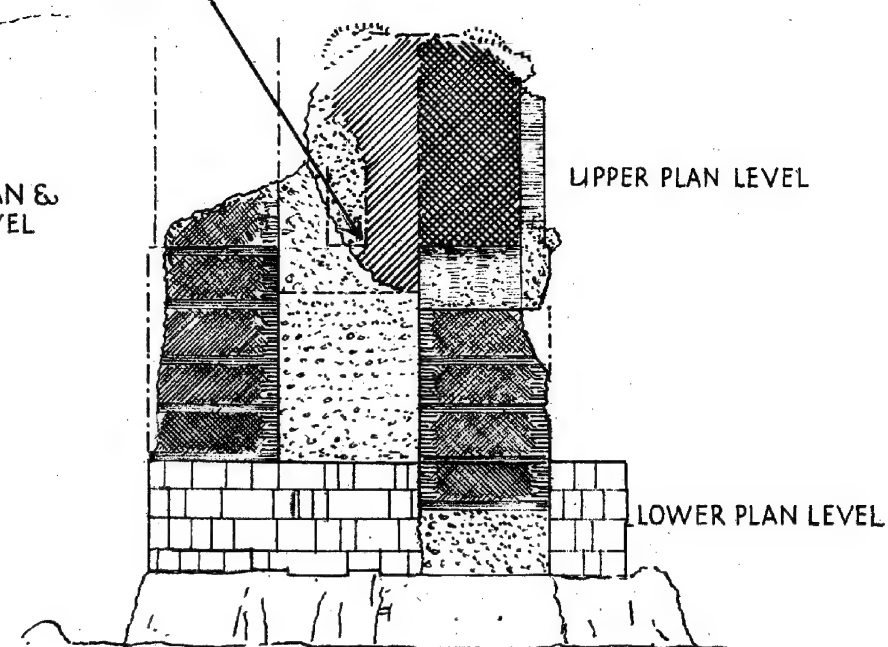
 REINFORCEMENT OPUS RETICULATUM
WITH BRICK BANDS & Tufa QUOINS

----- RESTORATION LINES

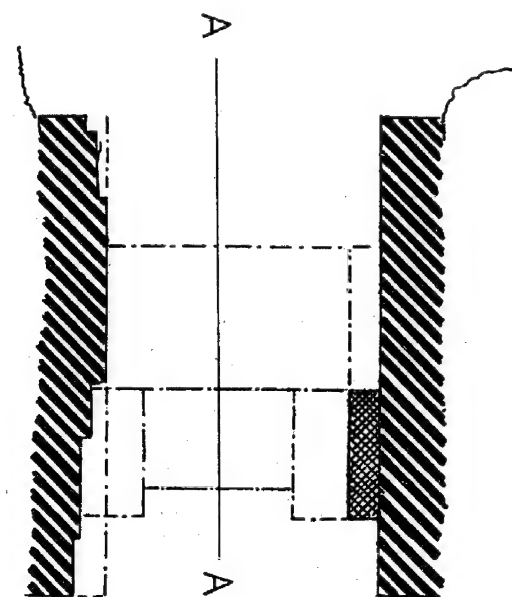


NORTH-WEST ELEVATION

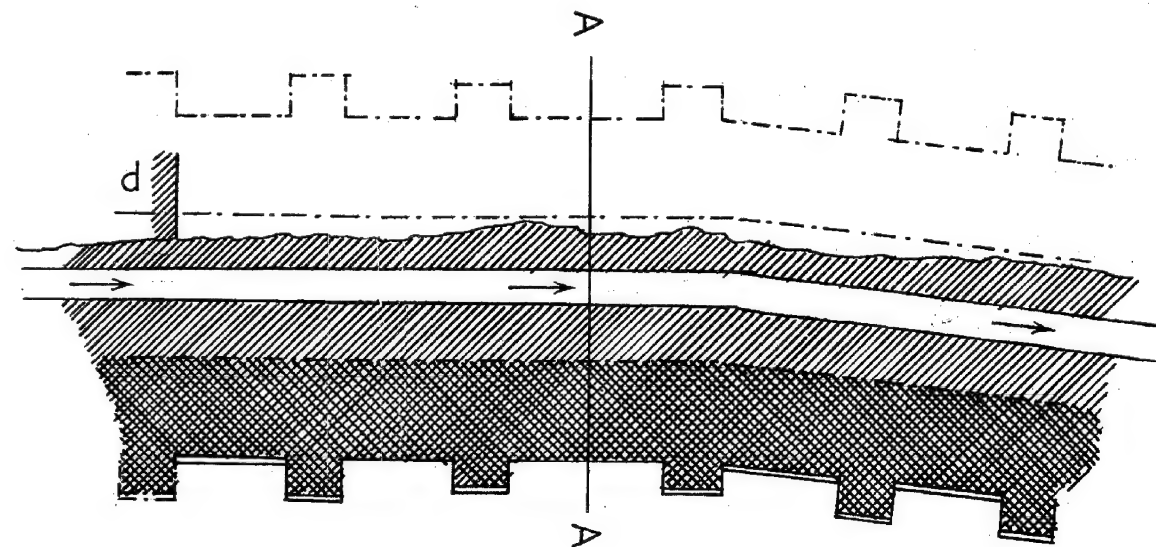
155.61



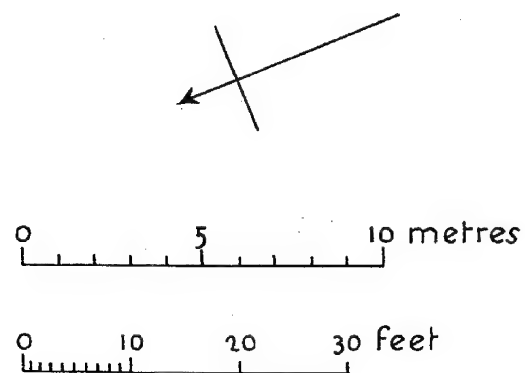
SECTION AA
SOUTH-WEST SIDE



LOWER PLAN



UPPER PLAN



Sig. Porziani, bailiff of the farm of S. Giovanni in Campo Orazio; it is inscribed ANI | IMP. CAESAR | DIVI F. AVG. EX. S. C. | DCCXXXIII. P. CCXL.

Another tufa *cippus*, probably belonging to the Anio Vetus, is lying in a field a few hundred metres to the west, but the inscription has entirely disappeared. In the lower portion of this *cippus*, left rough and buried in the ground, a circular hole 0.20 m. in diameter is cut to take a wooden beam for keeping the stone in place.¹

On Colle Fatturo, to WSW., are two *putei* belonging to this aqueduct, 37.70 m. (127 Roman feet) apart from centre to centre: they are 1.20 m. square, with outer walls 0.75 m. thick, and are lined with *opus reticulatum*.

Garrucci² states that he saw two *cippi* (659 and 669) of travertine *in situ*, one at the Obrego dell'Eremita (also called the Macchia dell'Olmeto), the other at Le Selle. They bore respectively³ the inscriptions IMP. CAESAR | DIVI. F. AVGVST. EX. S. C. | DCLXIX. P. CXXL. and IMP. CAESAR | DIVI. F. AVGVST. EX. S. C. | (d) C(l) IX. P. CCXL. The missing name of the aqueduct was probably illegible. But the author has been unable to find or to hear of either stone.⁴

The Obrego dell'Eremita is a medieval or modern chapel, situated nearly a mile north of Grotta dell'Acqua, on the south-west edge of the valley called *Fosso dell'Obago* on the map, a deep ravine between Colle Grotta dell'Acqua and Colle Fatturo. Owing to the brushwood the building was inaccessible. Two vertical shafts in the rock on the north-west bank of this valley, just below the Grotta dell'Acqua and the vineyards near it, may also belong to the Anio Vetus, if we have not over-estimated its windings, though there was no deposit near them. They are much overgrown, and it was impossible to descend into them. One measured about 0.50 by 1 m. at the top, the other, farther south, was not to be measured; there were said to be others in the undergrowth.

The district of Le Selle lies to the south, south-west, and west of the Grotta dell'Acqua, where the Marcia does not run. This being so, it may be fairly assumed that the *cippi* belonged to the Anio Vetus,⁵ though epigraphically indistinguishable from *cippi* of the Aqua Marcia. This gives a fair idea of the probable course of the aqueduct. It cannot have crossed the deep valley at the

¹ *Builder*, 143.

² *Bull. d. Inst.*, 1861, 39.

³ *CIL*. vi. 1243d = 31570b (where DCLIX is wrongly given) = xiv. 4084: and *CIL*. vi. 1243c = 31570a = xiv. 4083.

⁴ Dressel searched for 659 fruitlessly in 1878, and failed to find Le Selle (*Builder*, 143).

⁵ Dessau, *EE*. ix, p. 493.

Obrego dell'Eremita, but rather at a shallow point, well south of the two shafts of the Colle Fatturo; it would then run up to Obrego dell'Eremita (*cippus* 669) and double back again to Le Selle (*cippus* 659), round the shoulder of Colle Grotte dell'Acqua.

From Le Selle the aqueduct ran down the little valley north of the Capanna (marked on the map at point 216 close to *caposaldo* 120) and then turned across the saddle into the main Rio Secco. Here, to the north-west of the Ponte Taulella, a tufa *cippus* 645 of the Anio Vetus is still *in situ*, facing west by north. It bears the inscription:¹ (i)MP. CAESA(r) | D|vl. F. AVGVST. EX. S. C. | (d)CXIV. (p.) CCXII. Fifty paces down the hill is another block, looking like a *cippus* turned upside down, and certainly not *in situ*.

An idea of the sinuosity of this underground sector of the aqueduct is given by the distance between this *cippus* and *cippus* 733, close to Ponte Lupo. The presumed distance between the two points along the line of the aqueduct was 88 by 240 = 21,120 Roman feet, or 6,273 m.; whereas the direct distance on the map is only about 2,000 m. It is therefore shown winding, as in the map, to make up the amount. Within this distance, *cippus* 669 is 1,711 m. from *cippus* 645, and rather less than 1,000 in a straight line; but it is not easy, even so, to fill in 4,562 m. between *cippi* 733 and 669. The *cippi* were perhaps unevenly spaced.

Ponte Taulella (Pl. II a; Fig. 3) crosses the valley level with its main floor, in which the stream has cut a still deeper channel, now overgrown. Its present form,² which is not original, started with a single arch of brick, carried on a base of tufa ashlar 13.40 m. wide. The brick arch had a span of 6 m., and its lower voussoirs have given way, disclosing now inaccessible brick-stamps.³ The *specus* walls are of *opus reticulatum* and small tufa blocks; later, they were reinforced in *opus reticulatum* with brick bands, and in a third period in *opus reticulatum* and brick (see north-west elevation) with buttresses,⁴ reducing the span of the arch to about 4.50 m. The arches of both restorations are of brick. The arch is still preserved, but the lower portions of the buttresses whence it sprang have fallen. The original state will be clear from the elevation, section, and plans, of which one is taken at the level of the *specus*. Much of the central portion of the bridge has fallen, and the foot-path now crosses on top of the later north-west supporting-wall, the upper part of the other having collapsed. A landslip to the

¹ *Bull. Com.*, 1899, p. 38 = *EE*. ix. 968: the stone is 0.75 m. high, 0.525 wide, and 0.29 thick. The prepared face is 0.69 high, the inscription occupying 0.30 at the top. The first line is 0.55 high, the second 0.44, the third 0.40 m. In the last line V and the second C are damaged.

² Dr. Van Deman assigns the original structure to Agrippa and the reinforcements to the Flavian and the Hadrianic periods.

³ The author could not read them, even with a field-glass.

⁴ At *d*, a buttress of the first period (below the upper plan level) projects 1.35 m. or more.

south-east has revealed some buttresses of *opus reticulatum* with tufa quoins, at an inaccessible height, but below the plan-level; these are shown in outline. The *specus* floor lies at 155.61 m.

The *specus* wall is 1.60 m. thick, of *opus reticulatum* with a band of brickwork along the middle. The conduit seems to have been open (IV. 4), and has the characteristic dark crumbly deposit, 0.04 m. thick on each side. The quarter-round moulding at the bottom is 0.10 m. high, projecting 0.10 m. Where the section was taken there is a buttress of the first period below plan-level with offsets 0.20 m. and 1.15 m. wide. There is a piece of fallen brickwork about twenty-five yards down-stream.

To the south-east of the Ponte Taulella a rock-cut path ascends, 1.75 m. wide and possibly ancient. Along it the author found, in 1899, *cippus* 626, with the inscription:¹ ANI | (im)P CAESA(r) | (d)I(v)I. F. AVG. EX. S. C. | DCCXXVI. P. CCXL. With it were some ashlar blocks, possibly from a *puteus*. The *cippus* had, no doubt, been found in cutting the brushwood, but was obviously not *in situ*, as it must have stood at a distance of no less than 2,160 Roman feet (641.5 m.) from *cippus* 645, which lies only about 300 m. away from the farther side of the bridge. It had probably fallen from the top of the hill.

At the top of the ascent from Ponte Taulella there is much deposit on the hill; and farther west, on the ridge of Colle Caipoli, south-west of Colle Grotta dell'Acqua, there was a *puteus*. The aqueduct tunnelled straight under this narrow ridge, and issued in the Valle della Mola, whence it ran south-east to Ponte Pischero. Another path descends into this valley also; it is about 2 m. wide, and may be ancient. Just before reaching the Fosso di Caipoli, the *specus* is seen, 1.24 m. wide, and 1.97 m. deep from the intrados to the bottom, which is of rock, slightly curved, with no deposit upon it,² though there is hard crystalline deposit on the roof slabs. The sides are of ashlar tufa, reinforced in fine Augustan reticulate, and the roof is a gable, made of two tufa blocks, each 1.20 m. long and 0.42 m. thick (Fig. 4).

The aqueduct now crosses the Fosso di Caipoli, at a well-chosen point just before its junction with the Fosso Collafri, the combined streams being known as the Fosso della Mola. There are two original bridges³ here, the most interesting in the whole line of the Anio Vetus (Fig. 5). One carried the aqueduct, and the other the official path running by its side. Both were later joined by a mass of concrete faced with fine small Augustan *opus reticulatum*, which ran down as a retaining-wall into the stream.⁴

¹ *Bull. Com.*, 1899, 38; *EE*. ix. 969. The letters in the first line were 0.06 m. high and 0.042 in the rest. The stone has now disappeared.

² *Livellazione*, 37 (IV. 3), see fig. 25. Intrados, 155-99.

³ *Builder*, 143

⁴ The mass shown on the south-east bank in the plan is fallen.

The arch of the aqueduct-bridge has collapsed, but its haunches remain, formed by projecting blocks, 0.44 m. high, cut so as to form an arch but not true springers. It is uncertain whether there was a keystone or not. At the southern end of the bridge the *specus* can be reached with difficulty. Its roof is flat and formed of single slabs of tufa. It was originally 1.20 m. wide, and the sides consisted of four courses of tufa ashlar, each 0.45 m. high, and very finely cut and jointed. This would give a height of 1.80 m. for the *specus*, and this was all that was visible. On clearing the

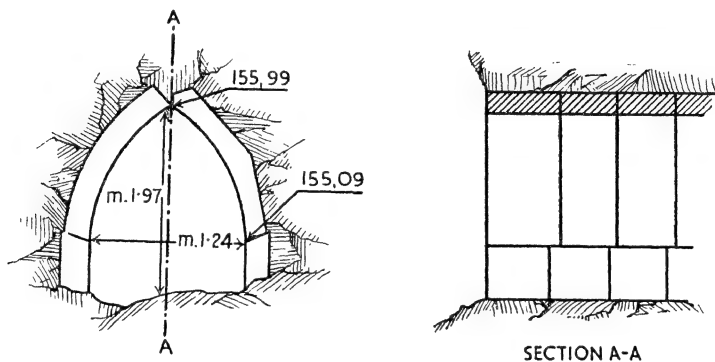


FIG. 4. Anio Vetus at Fosso di Caipoli

soil for another 0.45 m. we did not reach the bottom, but the stonework below the fourth course seemed to become rough. At a later date, when the arch over the stream was reconstructed, the *specus* was reduced in size by the insertion of concrete to 0.59 m. in width and 1.30 m. in height, 0.20 m. of concrete being introduced at the top.

The bridge for the pathway is 10.50 m. long and only 1.80 m. wide. It is a higher, one-arched bridge, also of original ashlar. The rock has given way at each side, but the structure stands. The arch is turned with a double ring of voussoirs, each 0.46 m. deep, which is also the dimension of the coursing; the voussoirs are arranged to run alternately through the whole width and half the width.

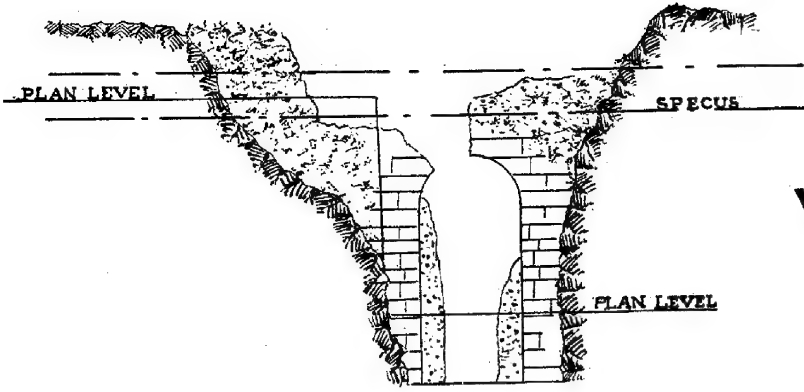
Below the bridge, at the mouth of Fosso di Caipoli, on the left bank, there is a pier 0.60 m. wide, in tufa and brickwork, and a lofty structure in *opus mixtum*, on whose south-west side is a bank of deposit about 2 m. thick. This perhaps marks the site of a clearing tank.

The course of the aqueduct is now continued by a line of *putei*, on the north-east side of the road leading south-east from the Mola to Ponte Amato, where it joins the modern road from Galliciano to Cavamonte.¹ Some still communicate with the under-

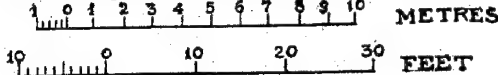
¹ Three other structures, unconnected with the aqueduct, may be noted here. The first is an embankment-wall on the north-east bank of the Fosso di Mola, below the waters-

FIG. 5

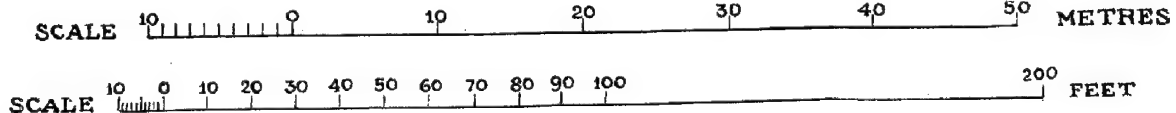
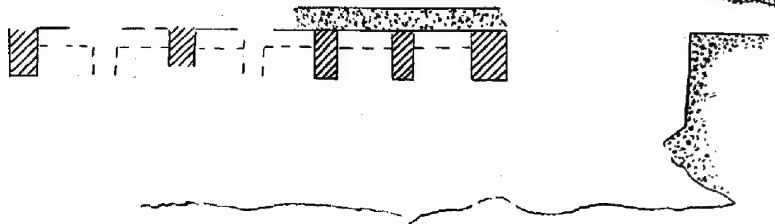
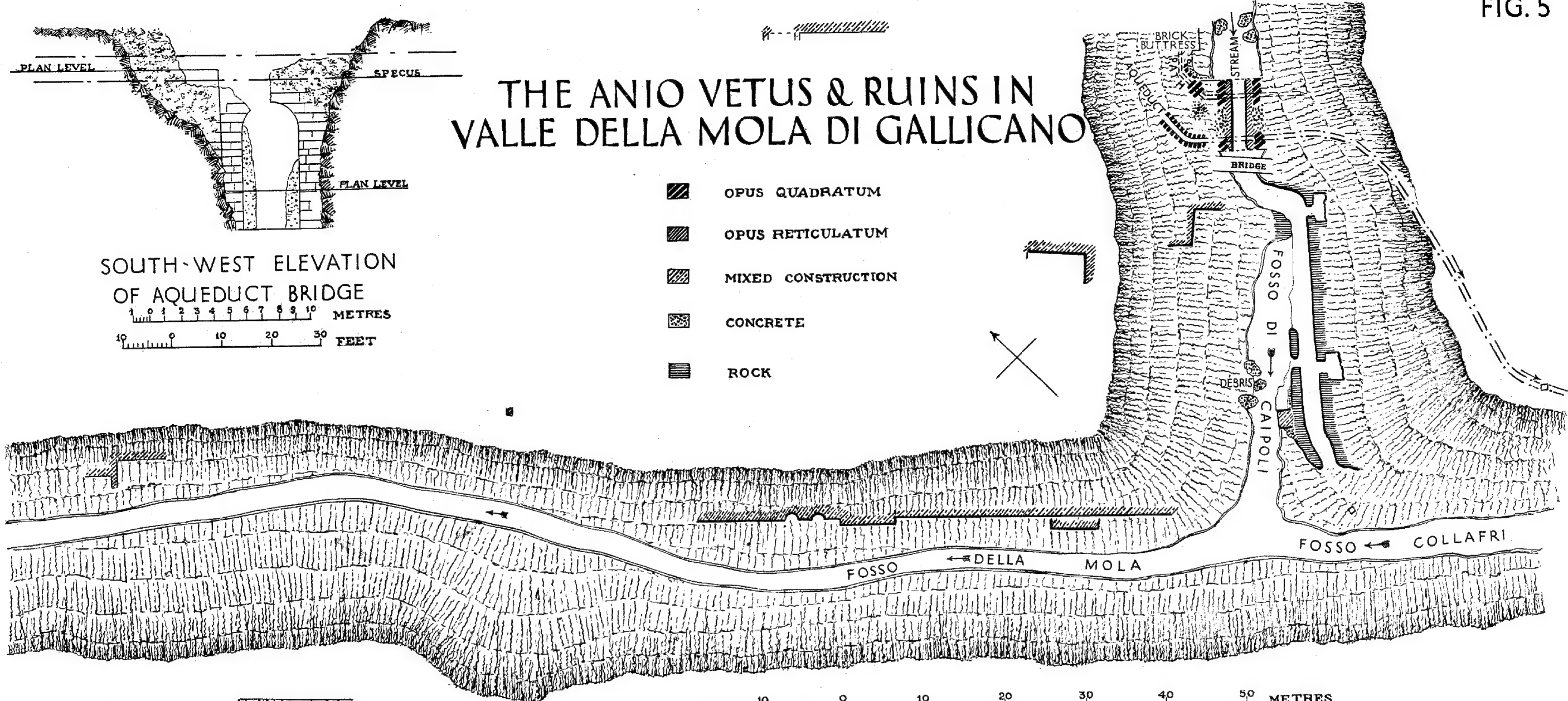
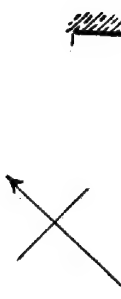
THE ANIO VETUS & RUINS IN VALLE DELLA MOLA DI GALLICANO



SOUTH-WEST ELEVATION
OF AQUEDUCT BRIDGE



- OPUS QUADRATUM
- OPUS RETICULATUM
- MIXED CONSTRUCTION
- CONCRETE
- ROCK



ground channel of the aqueduct, which supplies the mill with water. They are about 1.20 m. square, and are lined with *opus reticulatum*; the first four are spaced at just over 30 m., or 100 Roman feet, from centre to centre.¹

The first *puteus* is accessible from a small cave, now used as a stable, opposite the mill; it measures 0.60 by 1.50 m., but is choked. The level of the present bottom was 155.79; but not even the top of the *specus* could be seen. The second is also dry. The third was 9.80 m. deep² from the ground-level. The next three intervals measure 45, 49, and 70 paces. An intermediate *puteus* may have divided the 104 paces between the sixth and seventh. The last shaft visible is modern, at 218 paces farther on across the path. It is 13.50 m. to the water-level from the top, the total depth being 16 or 17 m. There follows a rock-cut *specus*, 0.80 m. wide and partly blocked by deposit, running 30° S. of W. as if to indicate that the aqueduct turned sharply to cross the stream here and continued towards the south-west. The intrados was levelled at 156.09 (IV. 2), which is only 0.10 m. higher than IV. 3.

Beyond this point, the Anio Vetus must have tunnelled under the narrow Colle Selva and the valley of the Fosso di Valle Inversa, which contains the modern high-road. It emerges on the south of the Colletto, a north-eastern spur of the ridge known as Colle S. Angelo, whose highest part is Colle Vigna. Here there is some deposit attributable to the aqueduct on the east ledge of a brook running into the Fosso dell'Acqua Nera, just north of Via Praenestina. Much deposit marks the crossing of the Fosso itself, about 600 m. below Ponte Diruto and 300 m. below the Marcia; and some also appears in the west branch of this stream, where

meet. It probably retained a villa, for cement floors remain and one wall exhibits white marble facing. The embankment-wall is of rough concrete faced in *opus incertum*; its niches are arched with tufa voussoirs and faced with *opus incertum*, tending towards reticulate: the mortar is greyish and very hard. Two buttresses have been added later, the one at the north-west end covering three of the five curved niches at that end of the platform. Farther downstream is some unfaced walling of rough concrete and good period. A little *opus reticulatum* also appears, with cubes 0.12 by 0.10 m., set in grey friable mortar with joints 0.03 m. thick.

Opposite this walling, on the south-west (left) bank of the stream is a second concrete building, massively buttressed and faced with *opus reticulatum* with brick bands and tufa quoins. The buttresses are connected at the top by arches in stone. Further walling to the south-east looks mostly post-classical, though its lower portions may be earlier. A channel in the upper part of this wall is filled with heavy deposit from the local stream.

Thirdly, under the left bank of Fosso Caipoli is a conduit 2.50 m. wide, reduced to about 1 m. at the mouth. There are also two branches at right angles, and large rock-cut barrel-roof chambers, now half-filled with earth; their purpose is quite uncertain, unless they served the mill. The stream has abandoned this passage, and made its way through elsewhere.

Finally, two rock-cut drains or conduits may be mentioned. One lies between the Ponte Piscero and the mill, in the miller's garden, the other at right angles to the road just south-east of the mill. Each is about 0.80 m. wide and was originally about 2 m. high.

¹ In *Builder*, 143, only three are noted.

² *Livellazione*, 27, top, 163.74; water-level, 153.94.

concrete foundations may be seen.¹ An ancient road seems to have run between the Anio Vetus and the Marcia, at least as far as Fontanile del Linaro, north of which there is more deposit. On Colle di Quadraversa, west of a small stream, well beyond the Fontanile, there is a *cippus* in position. Its top is damaged, but its size corresponds to the others of this aqueduct. Close to it, on the north, is another, not *in situ*. At 159.50 m. from the fixed *cippus*, a line of *putei* begins. The first, on the east slope of the ridge is rock-cut, and about 1 m. square. It is followed at 79 m. by round *putei*, with mouths faced in rough concrete, at intervals of 41.50 m., 39 m., and 38.30 m. The direction is 20° S. of W. Ten metres farther on comes a pair of *cippi*, 4.60 m. apart at nearest, which are on a slightly different line, though certainly belonging to the same aqueduct.² *Caposaldo* 89 (175.13 m.) was placed on top of the southernmost.

Fifty metres south, on the east bank of the ravine of the Fosso di Biserano, is a pier of the aqueduct-bridge built of ashlar, in tufa blocks as much as 0.76 m. high, quarried on the east bank of the ravine. The total height preserved is 5.05 m., and the width about 3.55 m. The technique shows that it is not original, and it is assignable to Augustus;³ on this view, a little *opus reticulatum* of good quality on the east bank may be considered Flavian. Failing traces of the *specus*, no level was taken. But characteristic aqueduct deposit shows the purpose of the bridge, which was far too inaccessible for a road.

The Anio Vetus, like the other aqueducts, must have passed deep below the shallow west branch of the Fosso di Biserano;⁴ but 200 m. south of the confluence there is a *puteus* which may be attributed to it, opposite those on Colle di Quadraversa described above (see Map 4).

No remains appear at Fosso di Pallavicina; but a *puteus* appears on the east bank of the east branch of the next stream, Fosso Cavallino. It measures 0.60 by 0.99 m. and is lined with *opus reticulatum* in *selce*. On the west side of the stream, a sector about a kilometre long runs round the north end of Monte Falcone, to avoid tunnelling through the hard beds of *selce* to the south. Its general direction is first 15° W. of N.; but at the north end of the hill, below the scanty remains of a villa, it begins to run west-

¹ *Builder*, 174.

² *Builder*, 175, must therefore be corrected.

³ According to Dr. Van Deman.

⁴ About 150 m. north of the confluence, on the east bank, is a rock-cut shaft, 0.80 m. square, in the north side of which a channel is visible, going 25° W. of N. It is roofed with stone slabs, and is 9 m. below the edge of the shaft and nearly 10 m. below ground-level. Another shaft, now filled, is to be seen 50 m. farther north-west on the edge of the stream. These two shafts are much too far north to go with the aqueduct, as formerly supposed (see *PBSR*. i, map iv); they belong to a branch of it, or probably to a drain, as no deposit lies about.

wards, and *opus reticulatum* is to be seen on its internal face. Turning still further, it runs due south along a natural terrace on the slope of the hill (see map). It is lying at about 105 m. above sea-level,¹ and is still visible for about 400 m., running along the hill-side, and restored in late, rough concrete. The *specus* had a rounded top, moulded on planks. The base of a *cippus*² appears *in situ*, with inner face 1.15 m. from the aqueduct. At 70.42 m., practically 240 Roman feet, comes another *cippus*, also *in situ*; and the curving intrados of the aqueduct may be seen, giving a width not less than 0.96 m. At 4.50 m. from the south edge of this *cippus* occurs a *puteus* of uncertain width and late date. It measures 0.90 m. from north to south. The aqueduct then curves, first to 12° W. of S. and then to SW., and at 129 m., or 437 feet, reaches a third *cippus*, entire but without visible inscription. The divergence from the normal double interval of 480 feet should be noted. After a short interval, in which nothing is visible, occurs the little valley between the *m* and the first *a* of *Romanella* in the map. Here the stream has exposed the conduit, 0.69 m. wide, going 20° S. of W. Its sides are of large rough stones, both tufa and *selce*, but on the west bank, where the south side is broken, later repair-work appears in brick-faced concrete, and the width increases to 0.93 m. A fourth *cippus* also appears.

Little is now to be seen for some distance. Fifty metres below the line of the aqueduct runs a paved road, apparently following the slope. It is uncertain whether this came up from the springs of the Aqua Alexandriana; but a branch seems to have led across the basin of Pantano to Via Praenestina at S. Primitivo, passing just east of the small brook east of the watering-trough, marked in the map at point 82. In the brook west of the trough the pavement is clearly seen, and a little farther on its kerb is also visible, running 30° S. of W. The aqueduct *specus* then appears some 30 or 40 m. higher up the slope. It is of late rough concrete, and is exposed in both branches of the brook. The tufa blocks, 0.40 and 0.50 m. high, belong to the original *specus*, which seems to have been 0.89 m. wide. A little farther on are the ruins of buttresses or of a small building near the aqueduct, followed at 60 m. by a *puteus*. This introduces a remarkably interesting sector, where the original aqueduct, roofed in blocks of light greyish-brown tufa, is enclosed in poor *selce* concrete, possibly Agrippa's work.

At the nineteenth kilometre on the modern Via Casilina, where an electric cable crosses to Pantano, the aqueduct appears in a tiny gully running 20° S. of W., as a hill-side *specus* of concrete faced with *opus reticulatum* of *selce*, quoined in *selce*, standing upon blocks of tufa. This is the last piece now visible; for the modern quarry

¹ Builder, 175.

² 0.50 m. wide by 0.28 m. thick.

rubbish has covered a similar piece seen by the author in 1900, running 40° S. of W. Just beyond, north of the enclosure wall on the north side of the Laghetto, the author also saw a *cippus*, giving the direction of the aqueduct as 27° W. of S. On the south-west side of the high-road south of the reservoir, at point 109,¹ there was probably a *puteus*. There is more deposit to the south-west.² Then the aqueduct seems to have taken a NNW. direction along the hill-side, followed by a course almost due west, with a slight southerly tendency. Deposit has been found some 300 m. to the north-east³ and north of Torre Iacova, and a rock-cut *puteus* exists about the same distance north-west, measuring 1.50 by 0.80 at the top. The course of the aqueduct continues to be traceable by means of deposit, which suggests that it took a very sharp bend to the north, bringing it close to the Torraccia di Forama. It then seems to have run south-west, keeping along the south-east side of the so-called Via Cavona⁴ for some way. In this sector, east of the tenth mile of the ancient Via Labicana, two more *cippi* appear in a field-wall, and on both banks of Valle della Morte, close to the Via Cavona, there seem to have been *putei* (see Map 3).

The aqueduct crossed under Via Cavona near Fosso del Cavaliere, and ran north of the Grotte Piatella.⁵ On the west bank of the west branch of Fosso del Cavaliere there is a *puteus*, at about 100 m. above sea-level. Some way SSE. of the Botte di Luciano, and SSW. of point 101, there is a tufa *cippus* in position,⁶ 6 m. SSW. of which is a rectangular *puteus* and much deposit. No obstacle is to be met between this point and Capannelle, and heaps of deposit, south of Torre dei Quattro Santi and near Casale di Gregna, suggest the straight course indicated in the map. The quantity of deposit east of the *piscina* belonging to the Claudia and Anio Novus, in Villa Bertone estate at Capannelle, may also be attributed to the Anio Vetus and the Marcia.

(d) *Capannelle to Rome. Map 1.*

The Anio Vetus lies so low that it could not possibly have emerged between Capannelle and Roma Vecchia. But it is clear that, as marked on the map, it must keep to the high ground traversed by the Via Latina, as do all the other aqueducts. Its characteristic deposit has been noticed in some places, but no

¹ PBSR. i. 236.

² In one of the small streams; and here are traces of a road running south-west by west, described in PBSR. i. *loc. cit.*

³ This is important, inasmuch as the existence of a distinct group of deposit here is one more reason for supposing that we are right in assigning to the Marcia the small bridge in *opus quadratum* farther up the valley (*infra*, p. 126).

⁴ PBSR. i. 240, 242.

⁵ PBSR. iv. 144.

⁶ It was on the south side of the road mentioned in PBSR. iv. 144.

PLATE II



a. ANIO VETUS: PONTE TAÙLELLA



b. AQUA MARCIA: ROCK-HEWN CHANNEL, S. COSIMATO

puteus has actually been identified. It is, then, all the more fortunate that a part of its *specus* was discovered¹ under the ridge on which the Marcia–Tepula–Iulia crosses from Roma Vecchia to Tor Fiscale, when the original railway to Naples was abandoned in favour of a newer line nearly forty years ago.

Part of the *specus* can still be seen on the west side of the railway under-bridge. It is extremely massive, and was undoubtedly subterranean. Lanciani notes that it was rectangular, 1.75 m. high by 0.80 m. wide; the tufa cover-slabs, 2.08 m. long by 0.25 m. thick, had often broken in two. The sides were of blocks in three courses, the topmost, 0.64 m. high, of tufa, the other two of *cappellaccio*. The bottom slab, unmeasured, was slightly concave.² The level of the bottom was 3 metres below the foundation-plinth of the Marcia piers. The modern ground-level was at 58 m. above sea-level, the Marcia foundation-plinth at 55.70.³ This would put the bottom of the *specus* of the Anio Vetus at 52.70 m. above sea-level.

Frontinus states that the Anio Vetus had a *piscina* rather less than four miles from Rome, on the Via Latina.⁴ This was no doubt the *Castellum Viae Latinae contra dracones*, mentioned in an inscription.⁵ The name *dracones* alludes to a fountain or an inn on the road, more probably the latter, but the *castellum* cannot now be located. On the other hand, it is true that the Anio Vetus left Via Latina about the fourth mile.

The *specus* of the Anio Vetus appears again in the quarry west of Tor Fiscale,⁶ for a distance of some 100 m. or more. Near the beginning of this sector, 100 m. west of the turn of the Marcia, a shaft lined with Augustan concrete leads into the *specus*, which is cut through the soft tufa without any lining, and has become enlarged to a width of 1.25 or even 1.50 m. Its original width

¹ *Sched. Vat.* 37, f. 50. Lanciani sketched it on 17 May 1890.

² Many of these details cannot now be seen; for the blocks of stone are covered with calcareous deposit due to percolations from the Marrana above.

³ Lanciani in *Not. Scavi*, 1890, 116: 'La ferrovia taglia la Marcia Tepula e Giulia (e Felice) . . . a metri 6975 dalla stazione centrale ed alla quota di metri 58 sul mare . . . Il piano di Campagna antico è inferiore al moderno di m. 2.30, e corrisponde al piano di risega del fondamento a sacco.'

⁴ *Frontinus*, 21. So much is certain; the rest of the passage, giving further topographical details, is corrupt.

⁵ *CIL*. vi. 2345: *D.M. Laetus publicus populi Romani . . . aquarius aquae Annionis veteris Castellum Viae Latinae contra dracones*, etc.; cf. *ibid.* 2344=8493, *D.M. Soter servus publicus castellar(ius) aquae Annionis Veteris*, etc.; and 2343, *Dis Manib. Julia Nereis et Diadumenus publicus aquae Annesis fecerunt*, &c. It is remarkable that none of these inscriptions spells the name of the aqueduct correctly.

⁶ Cf. *PBSR*. iv. 71: 'a stream-bed close by cuts through a channel (possibly a reservoir, though unlined) running through the *pozzolana*: it is about 1.50 m. wide, and the sides are partly covered with a very light (in weight) and dirty aqueduct deposit, about 0.10 m. thick. It is surprising that they are not lined with cement to keep the water in.' Cf. Parker, *Aqueducts*, 16.

was 0.90 m., and its height about 2 m., including the pointed roof. There is a good deal of deposit. The level is quite satisfactory, the bottom of the *specus* coming not more than 52.50 m. above sea-level. Nearer Tor Fiscale are other channels about 1.60 m. high and 0.50 m. wide with pointed tops. These form part of a separate local system for collecting and storing water.

The *specus* of the Anio Vetus was next found 'near Porta Furba', apparently where the military road, then a railway, passes under Vicolo del Mandrione,¹ at 55 m. from Aqua Claudia. It is described as follows, 'cut in the *cappellaccio*, without any lining of cement or *cocciopesto*.² The section of the vault is irregular, changing from semicircular to pointed in the short distance of 7 m. The calcareous deposit is considerable, and very hard. At the bottom of the channel it measures 0.12 m. thick, on the sides 0.18, and on the intrados 0.25. The whole of the channel is full of mud, regularly stratified.' The bottom of it was 1.40 m. above the level of the railway-lines. Twenty metres farther on, the *specus* was noted in the cutting of the Albano railway,³ at 25 m. east of Aqua Marcia, but only its top was visible, and it was not further explored. Nothing can be seen now at either place, and the exact level was unfortunately not taken.

A further sector was found in 1861, on the east edge of Via Labicana, 450 m. outside the Porta Maggiore. At first, it ran parallel to Via Praenestina, but where it was cut by the railway it turned towards Via Labicana, and the railway crossed it at right angles.⁴ Its sides were built of squared blocks of tufa or *sperone*, well fitted without cement, and it was roofed by two blocks set gablewise. The channel was 1.60 m. high, 0.80 m. wide, and encrusted with deposit. It was 4.60 m. below the modern ground-level, or 45.40 m. above the sea.⁵ This must have been part of the original aqueduct. At the same place a reservoir, perhaps for distribution, was found with walls of unfaced concrete. Farther on, before Via Labicana crossed the railway, Lanciani saw, under the vineyard wall on the right coming into Rome, the side of a wall at ground-level. This ran straight for over 140 m., and was of reticulate so like the Augustan restorations of the Anio Vetus,

¹ Lanciani in *Not. Scavi*, 1882, 66, 271; there is a sketch of it in *Sched. Vat.* 37, p. 67. This removes the possibility of the Anio Vetus having run as far as the north of Via Labicana (*Lanciani*, 49: 261, n. 1; see *PBSR.* i. 222, n. 1; and compare *Bull. d. Inst.*, 1842, 4, where there is a notice of the discovery of 'subterranean aqueduct' nearly 2 m. high, cut in the natural rock, which was found in a *pozzolana* quarry close to the Vigna Diamanti) for it would certainly have come out above ground-level.

² i.e. *opus signinum*, see glossary.

³ Lanciani in *Not. Scavi*, 1890, 12.

⁴ *Civiltà Cattolica*, 4, ix. 735; Lanciani, *Forma Urbis*, 32; *Bull. Com.*, 1874, 203. It is not correctly shown in our map.

⁵ This agrees very well with IV. 1, where the top is 46.15 m., the internal height 1.60 m., and the bottom level therefore 44.55 m., giving a fall of 0.85 in 500 m. or 1.70 per 1000.

that he did not hesitate to accept it as part of the ancient aqueduct, marking it as such in the *Forma Urbis*.¹ This, he thinks, must have been the beginning of the 221 paces (326.85 m.) of substructures mentioned by Frontinus. Du Pérac, indeed, in 1577 drew two aqueduct-arches just below those of the Aqua Marcia on the east of the Via Labicana, which may be a part of these substructures. They must, anyhow, have been extremely low, for the aqueduct had to pass under the Via Praenestina a little way outside the Porta Maggiore. Again, Piranesi noted part of the *specus* at the crossing of Aurelian's Wall,² and this, according to Nibby, was visible at ground-level until 1834, on the right as one entered Porta Maggiore.³ In 1833, the *specus* was discovered in the courtyard of the Osteria just outside the Gate.⁴ Still another piece was noted by Piranesi,⁵ corresponding to that previously observed, but at an interval which is not stated. He thought that these belonged to the Anio Vetus for three reasons; 'because the space is visible, which must have served as *specus*, or water-channel; because they are 25 palms (5.575 m.) above the ancient level of the ground, so that one cannot suppose them to have belonged to a drain; because they could not have belonged to the other aqueducts that passed by this neighbourhood.'⁶ The same sector became visible again later. Canina saw it at ground-level,⁷ and Parker photographed it,⁸ recording a piece of Augustan restoration in *opus reticulatum*, noted as 'now concealed (1869)' in the text to another photograph.⁹ The various *piscinae* which Parker enumerates cannot, however, be attributed to it with certainty.

Immediately inside the City Wall, east of Porta Maggiore, the original channel, in ashlar masonry of *cappellaccio*,¹⁰ was found

¹ 32; cf. *Bull. Com.*, 1874, 207.

² *Antichità Romane*, i, pl. xxxviii, p. iv, no. 14: '*specus* of the Anio Vetus which is seen buried in the city walls at the point no. 20 of the general index'. But if we look at the text to no. 20 we find it described as a piece of the conduit of the Marcia, Tepula and Iulia, and are given a reference to pl. x. 1 (reproduced by *Lanciani*, pl. 4, fig. 7A) where we find an aqueduct shown as running on arches, which suits the piece of the Marcia, Tepula, and Iulia immediately inside the Porta Maggiore, but not the Anio Vetus, to which the legend on the plate wrongly attributes it.

³ *Mura di Roma*, 345; *Roma Antica*, i. 339.

⁴ *Atti del Camerlengato*, tit. iv. fasc. 1790. On 30 July, 1833 it was found that the aqueduct had been broken through, and 29 tufa slabs removed. A letter was written to the secretary of the Cardinal Chamberlain, on behalf of the owner of the Osteria, relating that he had come across and removed some of the tufa cover-slabs of the aqueduct in repairing the yard and the entrance to the wine-cellar, and had not intended to do any harm; and on 12 August 1833 it was decided by the councillors of the Archaeological Commission that as the slabs had already been properly replaced and under their eyes he had begun to cover the *specus* with earth, he might be allowed to close the opening of the *specus* towards the road.

⁵ *Lanciani*, 50: 262; see pl. 4, fig. 7B.

⁶ *Op. cit.* i, pl. ii, p. 4, no. 20 (see also par. 7 of the text to the map of the aqueducts).

⁷ Canina, *Indicazione*, 170.

⁸ *Historical Photographs*, 1337.

⁹ *Ibid.* 59.

¹⁰ *Not. Scavi*, 1913, 6; *Bull. Com.*, 1912, 228 (*tufa gialla*). The blocks measured 0.48 by 0.28 by 0.67 m. (average length); there were five courses. The bottom lay in virgin soil,

close to the remains of the Aqua Marcia. Two *putei*, 0.75 by 0.83 m. with walls 0.60 m. thick faced in *opus reticulatum*, communicated with it. The first (A² in plan in *Bull. Com.*; B in plan in *Not. Scavi*) yielded a broken white marble column, and was already known to Lanciani;¹ it had deposit in it up to a height of 4 m., and still exists, south-east of the road leading under the railway to the goods station. Both shafts show traces of two periods. Near the first was found a small *castellum* (B in *Bull. Com.*; C in *Not. Scavi*) for the distribution of water—a chamber, 1.27 by 0.90 m., with brick walls 0.40 m. thick. The bottom was below the level of the top of the Anio Vetus. It was linked to the aqueduct by a channel 0.15 m. wide.² Into its west wall was built a travertine slab 0.25 m. thick, with four circular holes 0.06 m. in diameter and 0.06 m. apart, above which came an overflow. These holes held distribution-pipes, of which one remained, made of lead with an internal bore of 25 mm. At the bottom was a terra-cotta pipe, perhaps placed there to collect the overflow. None of these remains now exists. Another type of distributor was found near by, at A² (not marked in *Not. Scavi*) close to the aqueduct. This was a *peperino* block, like a truncated pyramid, 0.77 m. high, 0.56 m. square at the base, and 0.50 m. square on top. In the middle of it was a cubical cavity, 0.35 m. each way, fed by two holes, in one of which was a lead pipe.³

Immediately across the road that leads under the railway line to the goods station of S. Lorenzo a fine piece of the original underground *specus* is recorded. It was 1.60 m. in height and 0.83 m. wide. Its sides were of *cappellaccio*, in courses 0.24 to 0.29 m. thick, as is usual⁴ in this material. The roofing-slab was 0.70 m. long, 0.295 m. high, and 1.44 m. wide (IV. 1).⁵ Another concrete conduit,⁶ 0.80 m. wide, was found still farther east, almost entirely destroyed by Aurelian's Wall. It was higher than the Anio Vetus, and was lined with *opus reticulatum*; the east wall was 0.30 m. thick, while the west wall was thicker, because it contained a terra-cotta pipe, of 0.27 m. bore, showing traces of deposit. This has been attributed to the Aqua Appia Augusta,⁷ but the identification contradicts our knowledge of the levels of Aqua Appia.⁸

slightly hollowed; the cover slabs were 1.40 m. long by 0.30 by 0.50 m. The *specus* was 0.86 m. wide, and the deposit about 0.20 m., thick. See *Bull. Com.*, cit. fig. 2.

¹ *Forma Urbis*, 32.

² For the channel leading into it from the Aqua Marcia cf. *infra*, p. 142.

³ Editor's note: This cannot be a distributor, since it only has two holes; it resembles the pipe-collars of stone described by Vitruvius (viii. 6. 8) for use with leather pipes at an angle under pressure. Perhaps it was the joint between a lead and leather conduit.

⁴ As Dr. Van Deman has established.

⁵ *Livellazione*, iv. 1 (p. 17, fig. 4): floor, 44.55.

⁶ C in *Bull. Com.*; A in *Not. Scavi*.

⁷ *Bull. Com.*, 1912, 233.

⁸ *Vide supra*, p. 51.

The *specus* of the Anio Vetus was discovered again, immediately south-east of the Domus Percenniorum, while constructing the new road to S. Lorenzo, south of Porta Tiburtina.¹ A mutilated *cippus* was found, at a distance given as some 13 m. This is attributed by Lanciani, both in his plan and in his original publication,² to the Marcia–Tepula–Iulia. Huelsen³ gives it to the Anio Vetus, because it was of tufa, not travertine, and because it was described as ‘lying near the mouth of the *puteus* of an ancient aqueduct’. He connects it with another mutilated tufa *cippus*⁴ bearing the number 13,⁵ discovered in 1878, 49.30 m. north-west of Sixtus V’s Arch across Via di Porta S. Lorenzo. This *cippus* is said to have been found *in situ*, fixed in virgin soil 3.43 m. below modern ground-level, and was close to a *puteus*⁶ faced with *opus reticulatum* in tufa. In both cases Huelsen is right, for the Marcia here ran on arches: further, if the position of the third or fifth *cippus* of the Marcia is correctly noted, the distance to this point would be insufficient⁷ to take us to the thirteenth; and the same consideration applies in the other direction to the eighteenth *cippus*, which should be over 350 m. away, and is not much over 310 m. distant.

Another unnumbered *cippus*, attributable to the Anio Vetus,⁸ escapes the *Forma Urbis*. It was of tufa, and came to light *in situ* near the entrance of the former Vigna Giacosa, now covered by artillery workshops, at the corner of the Via Porta S. Lorenzo (Via Marsala) and the Via Castro Pretorio. The last three lines read . . . D[ivi] F. | AVGVSTVS | EX S.C.; but the material makes the attribution probable. Whether it was found *in situ* is, however, doubtful.⁹ Another *cippus* was found, also said to be *in situ*, only 1.80 m. away from the last, in digging the foundations for the workshops, bearing the inscription . . . AVGVST. EX S. C. III PED. CCCLXI. It is uncertain whether it belongs to the Anio Vetus or the Marcia.¹⁰

¹ Lanciani, *Forma Urbis*, 24.

² *Bull. Com.*, 1881, 12, 415; Lanciani, *Forma Urbis*, 18.

³ *CIL*. vi. 31558 f. In his maps, however, he shows it keeping south-west of the railway all the way through from Porta Maggiore, and marks the *specus* to which the 18th *cippus* belongs, but gives it no name. See *Forma urbis Romae*, i, ii.

⁴ It was 1.39 m. high, 0.50 m. wide, and 0.30 m. thick.

⁵ *CIL*. 31558 e; *Not. Scavi*, 1878, 167; *Bull. Com.* 1878, 98, no. 13; Gori, *Archivio*, 1879, 249 (who adds that the aqueduct was not examined—‘visitato’).

⁶ The *puteus* was 0.60 m. square with walls 0.68 m. thick (Lanciani, *Sched. Vat.* 37. 72).

⁷ Lanciani, *Forma Urbis*, 18.

⁸ Lanciani in *Bull. Com.*, 1885, 100, no. 1021; *CIL*. vi. 31558 d; j in our list, p. 57.

⁹ The distance from the 13th *cippus* is about 405 m. or 1,364 Roman feet, which is not a multiple of 240; while the 13th *cippus* is, in its turn, about 440 m. from the 5th *cippus* of the Marcia, whereas the interval should have been (had it really been the 13th *cippus* of the Marcia) about 570 m. Lanciani’s statement (92 : 304) that the *puteus* marked F (which is only about 10 m. from the 5th *cippus*) is 569 m. from it, is therefore incorrect.

¹⁰ *Infra*, p. 146.

The aqueduct, which had been running north-west, must now have turned at an obtuse angle, to run WSW. It was found under the street outside the ditch of the Servian *agger* and under the Republican Wall itself, in January 1861.¹ A *puteus*, lined with Augustan *opus reticulatum* and 16.50 m. deep, was found with the *specus* running through it, large enough to walk through if one stooped; and on each side of it stood a *cippus*, bearing the number 6, or 7. Huelsen prefers *vi*; Lanciani chooses *vii*, calculating the distance from Porta Esquilina as 496.84 m. (7×240 Roman feet). But if *vii* is chosen, the distance from *cippus* 13 is too great for the six normal intervals thus gained: seven intervals here give a better result, though there is still a slight excess. The reading *vi* is, then, to be preferred.² The position of this *cippus* is not shown in Lanciani's plan, but it lay 76.84 m. before the turn to the south, or some 13 m. from the beginning of the *specus* as he shows it. The nearest ground-level is 56.85 m. at the corner of Via Marsala and Via Castro Pretorio, which would give a level for the intrados of approximately 40.35 m., which is too low. Levels have so completely changed since 1861 that accurate calculation is now impossible.

After passing under the Wall, the aqueduct turned almost at right angles once more and ran south-east to the Porta Esquilina. Lanciani explains this sinuosity in its course by the desire to avoid the valley of the Villa Altieri. All known remains of the *specus* belong to the Augustan restoration.

Two³ *putei* were found where the line of the aqueduct is crossed by the Viale Principessa Margherita (now Viale Principe di Piemonte). An underground reservoir came to light in the Via Principe Umberto;⁴ it is described as a row of chambers built against a concrete wall 1.15 m. thick, faced with brick⁵ and *opus reticulatum*, which ran parallel to the *Agger*, and supported its mound. Each chamber measured 2.65 by 2.30 m. and was of considerable depth. The dividing-walls were 1.50 m. thick, pierced by arched openings 1.25 high and 0.50 wide. The solid construction leaves no doubt as to its purpose. The *specus* was found 2.50 m. away, 2.00 m. below ground-level, 1.60 m. high, and 0.42 m. wide, and lined with *opus reticulatum*; it was reached by a *puteus* lined with the same material, 0.64 m. square, with

¹ *Bull. d. Inst.*, 1861, 16; *Lanciani*, 50 : 262; *CIL.* vi. 31558 *b, c*. It is not shown in Lanciani, *Forma Urbis*, 17.

² Cf. *CIL.* vi, p. 3125: 'in lapide clare cernitur VI: num altera hasta post VI evanuerit, incertum est, nec tamen mihi probabile'. Herzog published the number as *vii*, but his notes show that he regarded the point as doubtful.

³ Three are shown in the plan given in *Monografia della città di Roma*, after p. 49.

⁴ *Lanciani*, 51 : 263, cf. *tav. iv*, figs. 8, 9. The position of the *Agger* is incorrect.

⁵ In *Bull. Com.*, 1874, 207, there is no mention of brickwork; and there is said to have been another wall of the same thickness on the other side of the chambers.

walls 0.63 m. thick and provided with foot-holes. This¹ and the last four *putei* were closed by blocks of travertine, pierced with a central hole, sometimes round and sometimes square, with a travertine plug. The hole in the cover-slab of the fourth *puteus* was worn with ropes, showing that the conduit had been regularly, but no doubt illicitly, robbed² by the bucketful. Not far from this *puteus* was found, overturned (*rovesciato*), a tufa *cippus*, with nothing remaining of the inscription but IIII [P(edes)] CCXXX. Hülsen thinks that the number was originally *iii*, which fits the normal interval far better than *iiii*, even allowing for the fact that this *cippus* was not *in situ*, and that the intervals were clearly not quite normal. Three more *putei* are indicated in the sector between this street and Via Principe Amedeo. The last of them, at the junction of Via Principe Amedeo and Via Manfredo Fanti, is recorded as being square, and too full of debris to be explored.

Further study was possible in this area in 1879, when houses were built on the north-west side of Piazza Manfredo Fanti, between Via Principe Umberto and Via Principe Amedeo.³ The original *specus* (A) was found, built in ashlar with a slightly concave base-slab. Three courses were preserved on each side, but the upper part had been restored in Augustan *opus reticulatum*, the outside, at C, being faced in the same material, while in one place there was brick facing. The height of the *specus*, usually 1.05 m., had thus been increased to 2.36 m., perhaps because the width had been contracted from 0.62 to 0.31 m. by deposit, of which there were three layers.⁴ Another *specus* (D) was included in the same mass of concrete. Like the first *specus*, it was falling from Porta Viminalis to Porta Esquilina; it measured 1.45 m. high to the impost (the vault being 0.23 m. high) and 0.65 m. wide; the interior was in *opus reticulatum* with brick repairs, while the floor was in some places of tiles, covered with cement only 0.02 m. thick, and a similar amount of deposit. The side-walls were 0.60 m. thick. At a distance of 5.70 m. from the external wall of D lay another *specus*, E,⁵ whose top came above ground-level. It was 0.40 m. wide, with side-walls 0.35 m. wide in brick. The cement-layer on the floor was 0.07 m. thick, and the channel was

¹ The *puteus* is not in *Forma Urbis*, 17, but is clearly shown, just south-west of Via Principe Umberto, in *Bull. Com.*, 1874, pls. v, vi, and *Monografia*, loc. cit. The *specus* to the left is called Tepula in *Lanciani*, 95: 307, tav. iv, 8. For the covers, cf. p. 151, n. 2.

² *Lanciani*, 337: 549; cf. *Bull. Com.*, 1874, 203, and De Montauzan, *Les Aqueducs antiques de Lyon*, p. 289.

³ In *Bull. Com.*, 1874, 210 it is stated that the buildings shown in the plan (V, VI, 15), to the north-east of Via Principe Amedeo, may also be reservoirs; they are described as a vast system of underground reservoirs in *opus reticulatum* like that of the *specus* (see also plan in *Monografia*, loc. cit.).

⁴ *Lanciani*, 52: 264, tav. iv, 1, 2, 5.

⁵ Details as to D and E are found only in *Sched. Vat.* 37. 12-14, and *Not. Scav.*, 1879, 140, where D is given as 1.45 by 6.75 m. (an obvious misprint) and E as 1.00 by 0.35 m.

filled with white clay. It is this *specus*¹ that Lanciani assigns to the Aqua Iulia.

From the south-west side of the Piazza the aqueduct crosses Via Mazzini (now Via Cataneo) very obliquely, emerging in Via Napoleone Terzo, where a circular *puteus* was found, 0.80 m. high and 9.00 m. deep.² It was lined with *opus reticulatum* at the bottom, and roughly repaired with bricks set in clay at the top. It was 145 m. from Porta Esquilina, and may therefore have corresponded with *cippus* 2. The *specus* has been traced hence to Via Carlo Alberto, about 100 m. north-west of the site of Porta Esquilina. At the corner of the two streets, opposite the Military Hospital of S. Antonio, the *specus* was found and destroyed in 1877, for a length of 18.20 m.; here it was of the original construction, and laid in virgin soil. The base-slab of *sperone* was 0.80 m. wide, with slightly concave surface. The sides were formed of two courses of the same stone, 0.53 m. wide and 0.52 m. high. The roof was formed of two tufa slabs set gablewise, though for a short distance a single horizontal slab was used. The width was 0.49 m. and the height 1.17 m.³

The channel of the aqueduct has not been traced farther than this point. Nothing is known of the details of its distribution within the City, except that Frontinus⁴ arranged that it should be employed for meaner uses.

(e) *The Capitoline branch.*

Nothing is known of this branch except the statement of Livy,⁵ *aqua Anio aqua [Marcia in Capi]tolium contra Sibyllae carmina [perductae]*.

(f) *The specus Octavianus.*

Little is really known of the *specus Octavianus*,⁶ which diverged from the Anio Vetus less than two miles from the City. No trace of the divergent *specus* has been found, and it is uncertain whether Frontinus⁷ is measuring along the Via Latina or along the *specus* itself, though the latter is the more probable. In the latter case, the junction would come about a mile outside Porta Maggiore, thus excluding entirely the *piscina*

¹ The ground-level is given as 39.80 m. in Lanciani's drawings, with the original *specus* about 8 m. lower; this is impossible, for the modern ground-level at Piazza Fanti is 55.64 at Via Principe Amedeo: see *Bull. Com.*, 1874, 203 and plan cit. The upper section on p. 200 only shows the *specus* with a pointed roof: it is not shown in *Forma Urbis*, 23 nor in *Monografia*, loc. cit.; see *Lanciani*, 95: 307 and tav. iv. 9.

² On this measurement, the modern ground-level, at 54.89 would make intrados at 45.89 and bottom at 44.29; this is a fall of only 0.26 m. in 1,750 m., which is too little; the source of the error is not clear.

³ *Not. Scav.*, 1877, 86; *Lanciani*, 52: 264, tav. iv, figs. 3, 4, 6.

⁴ *Frontinus*, 92.

⁵ *Epit. Oxyrhync.* 188-90.

⁶ *Lanciani*, 52: 264; *PBSR.* iv. 15.

⁷ *Frontinus*, 21; *PBSR.* loc. cit.

found by Parker in 1871, and assigned by him to this branch,¹ and also the remains similarly assigned by Fabretti,² which Parker and Lanciani assigned to Aqua Antoniniana. Thus, there are no remains which can be assigned to the *specus Octavianus* with any probability until the neighbourhood of the City is reached. There, according to Frontinus,³ it was distributed from the Horti Asiniani, in the district of Via Nova, both points unknown to modern topographers.

Fabretti⁴ attributed to the *specus Octavianus* a channel which he found 28 feet above the Aqua Appia in Vigna Santori, and to the Marcia another channel 6 feet higher. Lanciani at first⁵ rejected these as mere drains; later,⁶ he seems to have favoured the idea. But it is impossible to see these remains now, or to examine others which have been forced into, rather than traced as, a continuous line.

¹ *Aqueducts*, diagrams, pl. vi.

² 35; 30, tab. i, no. 25 (not 19); cf. 137, no. 15 and 130, tab. i, *id.*

³ *Frontinus*, 21.

⁴ 37; 31, tab. x.

⁵ *Lanciani*, 53 : 265.

⁶ *Forma Urbis*, 41, where both are inserted, the *specus Octavianus* with a query.

III. AQUA MARCIA

FRONTINUS describes the construction of Aqua Marcia, in 144 B.C., as follows:¹ 'Marcus restored the old channels, and brought in a third more copious supply . . . called Marcia after its maker. We read in Fenestella that 180,000,000 sesterces² were granted to Marcus for these works, and since the term of his praetorship did not suffice to complete the business, it was extended for a second year.³ At that time the Decemviri, consulting the Sibylline Books for other reasons, are said to have discovered that it was unlucky for the Aqua Marcia, or rather the Anio, about which tradition is more consistent, to be brought to the Capitol.⁴ The matter is said to have been debated in the Senate . . . but on both occasions the influence of Marcus Rex carried the day; and thus the water was brought on to the Capitol. . . .⁵

The springs were situated three miles to the right of the thirty-sixth mile of Via Valeria, and 200 paces to the left of the thirty-eighth mile of Via Sublacensis; its waters stood like a tranquil pool and were deep green in colour.⁶

To supplement the Marcia in droughts, Augustus brought an additional spring⁷ of the same excellent quality in an underground channel. It was called Aqua Augusta after him, and rose beyond the Marcia, being 800 paces long. The Aqua Augusta was turned into the Claudia because it was plain that the Marcia was of sufficient volume by itself. But it still remained a reserve supply to the Marcia, inasmuch as it ran into the Claudia only when the conduit of the Marcia could not carry it.⁸

This fact is repeated⁹ in a later context.

The Marcia's conduit has a length, from source to City, of 61,710½ paces. 54,247½ paces are underground, 7,463 paces on structures above ground; of which, at some distance from the City, in several valleys, 463 paces are on arches; nearer the City, beginning at the seventh milestone, 528 paces are on substructures, and the remaining 6,472 paces on arches.¹⁰

¹ *Frontinus*, 7.

² About £1,800,000 sterling.

³ Cf. Plin., *N.H.* xxxvi. 121. 'Q. Marcus Rex, having been ordered by the Senate to restore the conduits of the Aqua Appia, the Anio, and the Tepula' (an obvious mistake) 'brought in a new water, called by his own name, through channels hewn through the hills, within the term of his praetorship' (cf. xxxi. 46).

⁴ Cf. Livy, *Epit. Oxyrhync.* 188-90, which mentions both: *aqua Anio, aqua [Marcia in capi]tolium contra Sibyllae carmina [perductae]*.

⁵ A statue erected in his honour is mentioned in a military *diploma* of A.D. 64 (*CIL.* iii, p. 846) which was copied *ex tabula aenea, quae fixa est Romae in Capitolio post aedem Iovis O.M. in basi Q. Marci Regis pr(aetoris)*. An inscription of a man of the same name, as Consul, must belong to either 118 or 68 B.C. (*CIL.* i2, 660 = vi. 3825 = 31613).

⁶ *Frontinus*, 7.

⁷ Cf. *Mon. Anc.* cited below, p. 89.

⁸ *Frontinus*, 14. Fabretti (78 : 69 ff.) is at considerable pains to refute the theory of Holste, *Annot. in Cluv.* 713, 40, that the name of the Aqua Augusta lives on in the village of Aüsta, now Agosta; pointing out that the use of the name in the documents cited, relating to the abbey of Subiaco, is far too vague, and that the name is inaccurately used by the Scriptores Palatini. Cf. Paul V's bull (*Bull. rom.*, ed. Cocquellines, v, par. iv, p. 103, 1612) concerning the Acqua Paola, where Aqua Traiana is attributed to Augustus and confused with Aqua Alsietina, as below, p. 304.

⁹ *Ibid.*, 72.

¹⁰ *Frontinus*, 7.

In elevation it came fifth, after the Tepula, though equal in level to the Claudia at source.¹

In the Records Marcia is assigned a capacity of 2,162 *quinariae*. Gauging at the source, I found 4,690 *quinariae*—2,528 *quinariae* more than appear in the records. Ninety-five *quinariae* were delivered before it reached its settling-tank, and 92 were given to supplement the Tepula, also 164 to the Anio. The total delivered before the settling-tank was 351 *quinariae*. The quantity which is computed at the tank from gauges placed there, including what runs round the tank and is received in the arched conduit, is 2,944 *quinariae*. The sum of what is delivered above the tank or is received in the arched conduit is 3,295 *quinariae*: more than the recorded capacity by 1,133 *quinariae*; less than the gaugings at source by 1,395. After the tank, it consumed 1,840 *quinariae*—227 less than we said was in the scheduled capacity, and 1,104 less than the arched conduit receives from the tank. The total loss either between source and tank or after the tank was 2,499 *quinariae*, which, as in the other aqueducts, we found to be intercepted at several places. That the flow does not cease is clear from the fact that at the source, besides the volume which we noted as taken by the capacity of the conduit, there is an overflow of 300 *quinariae*.²

It is very possible that two arches of the Marcia are represented on a coin of C. Marcius Censorinus, about 87 B.C.;³ while five appear on coins of L. Marcius Philippus,⁴ superscribed *aquam*.⁵ Whether these connote repairs or pride in ancestral traditions is unknown.

The Aqua Marcia shared in the repairs by Agrippa in 33 B.C.,⁶ and by Augustus in 11–4 B.C. An inscription⁷ recording the Augustan repairs in general is placed on the attic of the Arch which carried the Marcia across Via Tiburtina and was later built by Aurelian into a City Gate, now Porta S. Lorenzo. The text runs *Imp(erator) Caesar Divi Iuli F(ilius) Augustus Pontifex Maximus Co(n)s(ul) XII tribunic(ia) potestat(e) XIX Imp(erator) XIII rivos aquarum omnium refecit*. The completion of the work thus falls between 27 June, 5 B.C. and 26 June, 4 B.C.: its inception is dated by the *senatus consultum* of 11 B.C., recorded by Frontinus.⁸ The Aqua Marcia is further and expressly mentioned in the *Res Gestae Divi Augusti*,⁹ in the words 'rivos aquarum compluribus locis vetustate labentes refeci et aquam quae Marcia appellatur duplicavi, fonte novo in rivum eius immisso'.¹⁰

The Marcia is more frequently mentioned, often with the Virgo, by classical writers than any of the others. The actual information which they give is scanty,¹¹ usually amounting to justifiable praise of the exceptionally

¹ Ibid., 18.

² Ibid. 67.

³ *effunduntur* does not necessarily imply waste.

⁴ *British Museum Catalogue of Coins of the Roman Republic*, i. 301, no. 2419.

⁵ Ibid. 485, nos. 3890–5.

⁶ *Frontinus*, 9. Dio (xlix, 49) dates this restoration to 34 B.C., before the aedileship. This may be correct; see p. 161, for a wider discrepancy.

⁷ *CIL*. vi. 1244.

⁸ *Frontinus*, 125.

⁹ *Mon. Ancyr.* iv. 10, 11.

¹⁰ 'I repaired the channels of the aqueducts, which were collapsing with age at various points, and I doubled the Aqua Marcia by letting a new spring into its channel.' Mommsen, *R.G.D.A.*, 83, Hardy, *Mon. Anc.* p. 95; cf. *Frontinus*, 12.

¹¹ Such passages as Propertius, iii. 2. 14, *non operosa rigat Marcia antra liquor*; Plutarch, *Coriolanus*, 1, Μάρκιος δ' ἦσαν καὶ Πόπλιος καὶ Κόντος οἱ πλείστον ὕδωρ καὶ κάλλιστον ἐν Ῥώμῃ καταγαγόντες; Tibull. iii. 6. 58; Vitruvius, viii. 3. 1, talking about some hot springs being

fine water. The Elder Pliny's account¹ will serve as a sample: 'The most famous of all waters in the whole world for coldness and wholesomeness,' he writes, 'the glory of the city of Rome, is the Marcia, given to the City among other divine bounties. It was once called Aufeia, and the spring itself Pitonia. It rises in the furthest part of the mountains of the Paeligni, and passes through the country of the Marsi² and the Fucine lake, making straight for Rome. Then it enters its channel and appears in the district of Tibur, and travels for nine miles on arches. Ancus Martius, one of the Kings, first began to bring it into the city, then Q. Marcius Rex as praetor and M. Agrippa restored it again. . . . In comparing these waters the difference above mentioned may be detected: just as the Virgo is most pleasant to the touch, so is the Marcia for drinking, though the City has long lost the pleasure of both, because private ambition and avarice diverts what should be a source of public health into villas³ and suburban estates.' This is a collection of patent historical errors; and it is strange that Fabretti,⁴ even after writing on the aqueducts, revised his earlier views in favour of these statements. Cassio also was obsessed by the idea.

Repairs were undertaken by Titus in A.D. 79, recorded in a second inscription on the Arch spanning Via Tiburtina,⁵ which reads as follows: *Imp(erator) Titus Caesar Divi F(ilius) Vespasianus Aug(ustus) Pontif(ex) Max(imus) tribuniciae potest(atis) IX imp(erator) XV Cens(or) Co(n)s(ul) VII desig(natus) IIX p(ater) p(atriciae) rivom aquae Marciae vetustate dilapsum refecit et aquam quae in usu esse desierat reduxit.*

Status refers to Aqua Marcia in describing the villa of Manlius Vopiscus at Tibur,⁶ which was fed from it by a pipe carried across the Anio,⁷ and the *balneum* of Claudius Etruscus,⁸ which lay in or near the Campus Martius.

Under Frontinus,⁹ the Marcia was extended to the Aventine, though actual remains of this extension are to seek; while Hadrian's work is attested by remains, but not in literature.

The next known repairs took place under Septimius Severus. A fragment¹⁰ of a large marble tablet, which bore an inscription of A.D. 196, proves that so delicious that one feels no need of the spring water from the Fons Camenarum or the Marcia; Arrian, *Comm. de Epictet.*, *Disp.* ii. 16 (p. 179, ed. H. Wolf, Colon, 1595), τὸ γὰρ Μάρκιον (ὑδωρ) χεῖρόν ἐστι τοῦ Διρκῆς.

¹ N.H. xxxi. 41.
² We already get the story in *Strabo*, v. 3. 13, ἐκ δὲ τῆς Φουκίνας εἶναι τὰς πηγὰς ἱστοροῦσι τοῦ Μαρκίου ὕδατος, τοῦ τὴν Πώμην ποτίζοντος καὶ παρὰ τὰλλα εὐδοκμοῦντος ὕδατα.

³ Nero shocked the public by bathing in its water, and was said to have become ill as a result; see Tac. *A.* xiv. 22, where *fons* must mean the springs, especially as Nero had recently been, and probably still was, in his villa at Subiaco; *ad urbem deductae* emphasizes the enormity. Schiller, *Gesch. d. röm. Kaiserzeit*, i. 159, suggests that the illness came first and was treated with Antonius Musa's cold-water cure.

⁴ *De Columna Traiana*, 588, on the *emissarium* of Lacus Fucinus; noted by Cassio, i. 54.

⁵ *CIL.* vi. 1246.

⁶ Raffaele del Re, *La Villa tiburtina de Manlio Vopisco*, Tivoli, 1849; *PBSR.* iii. 164; Desideri, *Villa Manlii Vopisci*, Rome, 1913; Ashby, *Atti e memorie della società di Tivoli di storia ed arte* iv (1924), 18 = *Via Tiburtina*, 85.

⁷ *Silv.* i. 3. 66-7.
⁸ *Ibid.* i. 5. 26-8. Martial (vi. 42. 18), on the same bath-building, says *contentus potes arido vapore, cruda Virgine Marciae mergi*, recommending a cold plunge after dry heat. For Martial, ix. 18. 6 see below, p. 153; xi. 96. 1 adds nothing to knowledge.

⁹ *Frontinus*, 87.

¹⁰ The reference is to the fourth *tribunicia potestas* of Severus, not of Caracalla; *CIL.* vi. 1247. *Lanciani*, 61: 273, refers *amplia* . . . to the addition of fresh springs for the *Thermae Severianae* in Regio i.

repairs were made to the aqueduct in that year: its broken text runs *trib.] pot(estatis) iiii . . . aquam M[arciam] . . . iniuriis d . . . excisis [et perforatis montibus . . .] amplia (. . . integr (. . . , resembling, as De Rossi noted, the later inscription of Caracalla on the Arch at Via Tiburtina. This runs *Imp(erator) Caes(ar) M(arcus) Aurelius [sic] Antoninus Pius Felix Aug(ustus) Parth(icus) Maxim(us) Brit(annicus) Maximus Pontifex Maximus aquam Marciam variis kasibus impeditam purgato fonte excisis et perforatis montibus restituta forma adquisito etiam fonte novo Antoniniano in sacram urbem suam perducendam curavit*.¹ The date falls between 27 February 212, when Geta was murdered, and an unknown day in 213, when Caracalla took the title Germanicus. There is no definite information as to the site of the *fons novus Antoninianus*; but its addition must be connected with building the *Thermae Antoninianae* and their branch aqueduct. The original channel must also have been damaged by floods and bad weather.*

The construction of an additional channel by Diocletian seems attested by the *forma Iovia*, mentioned in late classical sources. The *Einsiedeln Itinerary*² and *Liber Pontificalis*,³ taken alone, suggest that only the branch to the *Thermae* of Caracalla was in question; though what the Popes would have gained by repairing this is difficult to see. Again, if Marsia may be a corruption of Marcia,⁴ it may also be a recollection of the *Marsas nives et frigora ducens* of Statius.⁵ Yet the *Thermae* of Diocletian must certainly have demanded an additional supply; and, as Lanciani points out,⁶ the *Iovia* occurs in tenth-century documents relating to the territory of Tivoli. For example, in 916, Pope John X confirmed the monastery of Subiaco in its possessions, among them 'fundum romani . . . inter affines ab uno latere fluvium tivertino et a secundo latere papi, et a tertio latere arcu fulgurati. . . et veniente per monte qui vocatur Bulturella . . . ab alio latere fundum munitula saliente ab ipso prato per limites suos, usque ad parietes desertas que sunt ultra forma et exeunte in via publica, a quarto latere fundum q(ui) v(ocatur) decorita aqua descendentes per limites suos usque in forma Iovia et exeunte per forma.'⁷ These topographical indications take us, as Lanciani

¹ *CIL*. vi. 1245.

² 13. 22 *ibi* (Porta Appia) *forma Iobia quae venit de Marsia, et currit usque ad ripam*. The last phrase is probably due to confusion with Aqua Appia, cf. p. 50.

³ *Lib. Pont.* i. 504, *forma quae Iobia vocatur, quae per evoluta XX annorum spatia ruinas confracta reiacebat, a fundamentis restaurare fecit* (Hadrianus I, 772-95). Cf. ii. 91, *hic sanctissimus praesul* (Sergius II, 844-7) *formam quae Iovia vocatur, quae per evoluta annorum spatia demolita atque a ruinis plena existerat . . . noviter eam restauravit; et tanta aqua abundanter praefulsit, quae pene totam civitatem satiauit*; and ii. 154 *formam aquae quae vocatur Iovia, at vero iam per evoluta annorum spatia nimis confractam existentem, per quam decurrebat aqua per centenarium in urbem Romam, a fundamentis ad fabricandum atque restaurandum eandem properavit* (Nicholas I, 858-67). Lanciani, 42: 254, follows Corvisieri (*Buonarroti*, 1870, *passim*) in reading Toccia in the last passage, and referring it to Aqua Appia. Cf. author's note on p. 50.

⁴ See Lanciani, 106: 318.

⁵ Cf. *ibid.* 63: 275; *Mon. Linc.* i. 515.

⁶ Lanciani, 107: 319.

⁷ Lanciani quotes this passage from *Regestum Sublacense*, doc. viii, A.D. 916, which I could not find in Allodi and Levi's edition. The monastery was reconfirmed in its possessions in 958 (doc. xii, p. 30, 3) and 973 (doc. xiv, p. 36 fin); cf. Kehr, *Italia pontificia*, ii, p. 87, no. 9, also nos. 18, 20. Cf. the Bull of Benedict VII (A.D. 998) published by Bruzza, *Regesto della chiesa di Tivoli*, p. 35; cf. p. 182: 'fundum baronianum in integrum. Inter affines incipiente per rivo usque in forma antiqua; a secundo latere monetula; a tertio latere fundum romani; et a quarto latere fluvium tyberis (really the Anio), et pervenientes usque in altis arcubus ubi est ponticello.' The *forma Iovi* mentioned in *Reg.*

shows, to the Valle degli Arci (the *arcus fulguratus* may well be one of the higher arches of the conduit), the *fosso* of the same name, Monte Vulturella, Colle Monitola, and the road along the Valle d'Empiglione. He maintains that they refer to the Marcia, though the Anio Novus passes close by; and, since the Marcia supplied the Baths of Diocletian, while the Anio did not, this view may be accepted. Indeed, the references in the *Liber Pontificalis*, to which he does not refer, considerably strengthen his theory; for it is unlikely that the Anio Novus was also running in the ninth century.

After Diocletian there is no record of work on the aqueduct for another century. Then fragments occur of at least three monumental inscriptions¹ of Arcadius and Honorius, closely dated by the Constitution of 27 November 399, providing for the future protection of the aqueduct after its repair.

The first, once not less than 7 m. long and completely to be restored, reads: *Imperator(ibus) Caesaribus domi[nis] nostris Flaviis Arcadio et [Honorio fratribus victor]ibus ac tri[um]fatoribus sem[per] Au[gustis] quod obsecuti | optimis providentissimisque | consiliis inlustris et praecla[ri] viri Fl[avii] Stiliconis com[itis] et magi[stri] utriusque mil[itiae] parentis su[i] reliqua ex | veneranda antiquitate Ro[m]ana r[e]i publicae monumenta u[n]iversa bona quae capta sunt | a Gildone² h[ost]e p[ub]lico [donan]do formas ad Anienis fl[uenta] | quorum aqua non modo nocebat | fossa[e] urbanicianae sed et vas[titatem] urbis per immen[sa] spatia gignebat [ob] squ[alore]s ac pern[ic]iem ext[endendo] instaurari paludesque pe[r] in[via] meatu novo iuvante etiam [praef]ecto urb[is] Quintilio? L[aeto] dispositione [egregia] averti oport[ere] iuss[erunt].*

The second is fragmentary and runs: *Salvis DD N[N. Arcadio et Honorio Victoribus ac triumphato]ribus sem[per] Au[gustis] perpet[ua] no[vum] alve[um] . . . formam. . .* It refers to a new cutting and to an aqueduct.

The third inscription is more intelligible, reading: *[Postquam DD. NN. edictis sui]s quibus et paludes siccarunt | [destinarant] opes quantas antiqui]tas habere non potuit ad purgandas | [formas, ob labores susceptos explic]itaeque merita[e] Senatus populusque | [Romanus virum clarissim]um et inlustr[em] Quintilium | [Laetum? praefectum urbi]s consecravit dedicavitque.*

Subl., doc. 105, p. 151 at the fourth mile of Via Labicana must, however, be Aqua Alexandriana, see p. 308.

¹ *CIL*. ix. 4051, cf. pp. 682, 698; *Lanciani*, 72 : 284: the Constitution is *Cod. Theod.* xv. 2. 8. The first inscription has been found piecemeal near the springs. Fabretti (108, 98) saw the first fragment of the second inscription in the altar of the chapel of S. Maria in Arsulis, on Via Valeria not far below Arsoli; other fragments were copied in the castle at Arsoli by C. L. Visconti; others, less important, were found in excavations by Stevenson, whose account never actually appeared in the *Bullettino Comunale*, as foreshadowed by Lanciani (his original notes on the subject will be found in *Cod. Vat. Lat.* 10564, 212 ff., but there is nothing of interest, except that the wages of 8 men and 2 women were only 10 lire 90 centesimi a day). The togate statue, associated with a vaulted building, found by Fabretti (67; *Diss.* ii, tab. 2) south-east of Ponte Scutonico, where the road from Arsoli meets Via Sublacensis, at point 330 on the map, a little west of La Moletta, may belong to the statue of Quintilius, though *Lanciani*, 74 : 286, refers it to the Emperors. Hereabouts was also found *cippus* 1242. Revillas wrongly places the spot ENE. of Ponte Scutonico.

² Gildo's rebellion began in 397, but was quelled the next year. His huge property was confiscated, and was administered by a *comes Gildoniaci patrimonii* (*Not. Dignit. Occ.* c. 12). There was a separate fund for the repair of aqueducts (Symmachus, *rel.* 20, *ex formarum conditis*; Valentinian III, *nov.* 5, *de pantapolis*, in fine, *cespes formensis*). This inscription shows that the whole of Gildo's property was used to increase it.

The works undertaken were the protection of the sources, evidently of the Marcia and Claudia, from invasion and pollution by floods of the Anio. To this end, while the conduits of these two aqueducts were restored and enlarged, a channel must have been excavated *per invia* to carry off the flood-water of the Anio. This was a revival of the measures which Caracalla had taken nearly two centuries before.

A second constitution was issued on 28 December, 401 referring to the finished works. It commands that 'Ex forma, cui nomen Augusta est, quae in Campania sumptu publico reparata est, nihil privatim singulorum usurpatio praesumat, neque cuiquam posthac derivandae aquae copia tribuatur. Si quis autem meatum aquae ausus fuit avertere, quinque libras auri aerario nostro inferre cogatur. Quidquid etiam ob eam fraudem ex rescripto fuerit elicutum, vel qualibet arte temptatum, inritum habeatur.' Lanciani¹ hesitates to refer this document to the Augustan spring of the Marcia because it is said to be in Campania; but Campania, from the time of Diocletian onwards, included Latium.

In common with the other aqueducts, the Marcia was no doubt cut by the Goths besieging Rome in 537. But it was repaired, and continued to run until about the middle of the eighth century, when Hadrian I restored it thoroughly after an interruption of twenty years. Two Popes of the middle of the ninth century² did the same, as already noted. In the tenth-century documents, cited above, it is referred to as *forma Iovia* and *forma antiqua*, somewhat as if it were still running. The date at which it ceased to be in use is unknown. No attempt to repair it was made in the Middle Ages; Alessandro Donati, the Jesuit, writing in the first half of the seventeenth century, goes no farther than to express³ a pious aspiration, *et forte accidet aliquando, ut etiam Marcia, illa aquarum regina, Dominae Urbi restituitur*.

The *cippi* of Aqua Marcia found between the springs and Capannelle are as follows:

	Number.	Interval (in feet).	In situ or not.	Place of Publication.
<i>a</i>	1242	240	No	<i>CIL.</i> vi. 31562g = 1251b = xiv. 4074.
<i>b</i>	1215	250	Yes	<i>CIL.</i> vi. 31562f = <i>E.E.</i> ix. 965. <i>Not. Scavi</i> , 1890, 164.
<i>c</i>	1197	240	Yes	<i>CIL.</i> vi. 31562e = xiv. 4075 = <i>E.E.</i> iv. 812.
<i>d</i>	1152	240 ⁴	No	<i>CIL.</i> vi. 31562d = 1251a = xiv. 4076.
<i>e</i>	960	240	No	<i>CIL.</i> vi. 31562c = 1250c = xiv. 4077.
<i>f</i>	945	240	?	<i>CIL.</i> vi. 31562b = 1250 ⁵ = xiv. 4078.
<i>g</i>	823	240	No	<i>CIL.</i> vi. 31562a = 1250b = xiv. 4081.
<i>h</i>	816	240	Yes	<i>E.E.</i> ix. 966; <i>Not. Scavi</i> . 1892, 52.
<i>i</i>	803	240?	?	<i>CIL.</i> vi. 31570c = 1250a = xiv. 4082 = <i>E.E.</i> ix. 967.
<i>j</i>	509	240	Yes	Unpublished.

¹ Lanciani, 74 : 286. *Cod. Theod.* xv. 2. 8.

² The extension of the Marcia by Trajan to the Aventine may be the *forma* of *Itin. Eins.* 11. 4, *inde per porticum usque ad formam per vii vias*; 13. 27, *inde per porticum usque ad formam*, and 28, *inde ad septem vias; ibi Sēa Lucia et Septizonium*.

³ *Roma Vetus ac Recens*, 300.

⁴ The interval is regular; contrast Lanciani, 75 : 287.

⁵ Here a wrong reading is given—the number as 946, and the interval as 282.

All bear the inscription MAR(cia) | IMP(erator) CAESAR | DIVI F(ilius) AVGVSTVS | EX S(enatus) C(onsulto). All are of travertine,¹ except 509, which is of local tufa.

Cippus 1242 was not *in situ*; but both 1215 and 1197 were, at an interval of 1,030 m. This distance gives an average interval of only 192.33 Roman feet;² thus, either some intervals were well below the normal 240 feet (the known exceptions are above it); or the aqueduct was much more sinuous than appears possible, since it must surely have followed the line of both ancient and the modern road, here running practically straight between the Anio and precipitous mountains. The accuracy of the basic 1,030 m. cannot be tested, since neither *cippus* is now in place. Assuming the normal interval throughout, the length of the aqueduct from *cippus* 1215 to Rome would be 86.605 km., to which about 3.5 km. must be added, as the distance from the springs, giving a total of 90.105 km. This agrees very closely with the measurement of 61,710½ paces given by Frontinus (91.400 km.) suggesting that between Augustan days and his own there had been little change. To place these on a map, however, raises other problems.

Our levelling operations did not reach the springs of the Aqua Marcia. Indeed, the farthest point (III. 34) is only 61.332 km. from Rome, close to the bridge over Torrente Licenza.³ Hence to *cippus* 1215 is a distance of about 3,500 m., and to the springs another 3,500 m. The approximate total, 68,300 km.,⁴ is far below the true length of the aqueduct. Two examples of the errors involved may be taken. From *cippus* 816 to *cippus* 509 the distance along the aqueduct should have been 21.873 km. (73,680 Roman feet); whereas from point III. 15 (about 200 m. south of *cippus* 816) to III. 5 (350 m. nearer Rome than *cippus* 509) the distance is 14.425 km. Again, from *cippus* 509 to Porta Maggiore should have been 36.281 km. (122,160 Roman feet); whereas from point III. 5 the distance is 28.825 km. Thus, as in the Anio Vetus, the aqueduct is presumably far more tortuous in actuality than as mapped. It would be impossible, however, safely to indicate its sinuosities without extensive excavation. This error has an influence on the inclines as calculated by us; they have necessarily been over-estimated, in some places more than in others, so that it is impossible to give a general figure. Nevertheless, these sinuosities explain the excess of 18,017½ paces in the underground sector of the Marcia over that of the Claudia, while the conduit above ground is shorter by 2,713 paces. Belgrand⁵ observes that 'M. Blumensthal, que j'ai consulté sur cette énorme différence, pense comme moi qu'elle tient au développement extraordinaire du premier (the Marcia). "En vous guidant", m'écrit-il, "sur les sinuosités de l'Anio, sur les rentrants formés par les *fossi*, les vallées et les saillies poussées en avant par les collines, vous arriverez à une assez belle approximation des fameux 61,710 pas."' His vindication of Frontinus is correct.

¹ Fabretti, 109: 101, states that 1242 was *marmorea*. This is wrong.

² i.e. 1,030 divided by 18, multiplied by 0.2975; cf. *Builder*, 95.

³ The remains close to Osteria della Spiaggia (see p. 99) belong to Aqua Marcia, not Aqua Claudia (II. 41).

⁴ The estimate given in *Builder*, p. 64 is 69.400 km.

⁵ Belgrand, *Les Aqueducs romains* (Paris, 1875), forming part of a large work on *Les Travaux souterrains de Paris*, p. 37.

(a) *The Springs* (Fig. 6).

NATURAL conditions at the springs of Aqua Marcia have materially changed since Roman times. The floor of the Anio Valley has been raised by the calcareous deposits of the river and of the springs themselves,¹ with the effect that the engineers of the modern aqueduct have often found the ancient channels 7 or 8 m. below ground: and the large pools in which water rose, until a few years ago, were due to leaks in the ancient collecting channels. The springs² themselves lie under the rocks at the edge of the valley. They come largely from the limestone mountains on the right bank of the Anio; but whether they derive from independent subterranean watercourses, or from one main feeder, is unknown. Analogy suggests the former, and gains some support from the fact that the springs lie at a distance from one another. The ultimate source is the rainwater collected in the basin of the Fioio, from Oricola, or Rocca di Botte, to a point below Monte Autore. This basin lies very high; the two ridges that flank it are from 1,200 to 1,600 m. above sea-level; and the floor of the Fioio itself is here a constant 700 m. above the Anio. The rainfall is considerable, 1,718 m. at Vallepietra, 823 m. high; and the snow lies late into the spring, explaining why the flow of Acqua Marcia is generally lowest in February. The springs themselves rise either from the point of contact between the limestone and the alluvial soil, or from the alluvium itself, as in the spring of Lago Santa Lucia, which rises through the alluvial soil as from a deep well. In fact, the alluvial soil of the Anio has covered the old outlet of the springs, and all the present springs, except those of the Rio d'Arsoli,³ rise through the river-bed, flowing at the low speed of 0.50 to 0.30 m. per second, while the Anio itself runs at over a metre per second, even in summer.

Thus, the present position of the springs is no clue to their precise ancient location, and one must return to the fixed point in Frontinus, the 36th mile of Via Valeria. The exact spot was identified in 1890, when a *cippus* and three milestones, all originally bearing the number 36, were discovered about 500 m. above the Anticoli bridge on the Anio, the pavement of Via Sublancensis being also found joining that of Via Valeria.⁴ The 38th

¹ See Morani in *Boll. ass. arch. Rom.* xiv, Nos. 11-12 (Nov.-Dec. 1924), 3.

² *Carta idrografica d'Italia; l'Aniene* (Rome, 1891), 53-60, on which these notes are based.

³ These are I and Ia of the list given in *Lanciani*, 65: 277.

⁴ Borsari, in *Not. Scavi*, 1890, 160 ff. He seems to be wrong in interpreting the *cippus* as an indication to travellers from Rome to take the main road. The *cippus*, inscribed with the number 36 and an arrow pointing towards Rome, was set up on the left-hand side of the Via Valeria. The first milestone, *CIL.* ix. 5967 in the fork of the roads, bore two inscriptions, of A.D. 305-6, to Constantius, Maximian, Severus II, and Maximinus, and

milestone¹ of the Via Sublacensis, by which the actual source lay, was seen *in situ* on its original base, then in the river-bed, by Fabretti.² He placed the point³ at nearly 3 miles from the divergence at milestone 36; whereas it really comes somewhere opposite the second Serena, at point 331 on our map. Hence 200 paces to the left brings us to the first Serena. Frontinus, however, still remains difficult to understand; for when it is known that Via Sublacensis diverged from Via Valeria precisely at the 36th mile and that the springs were 200 paces to the left of its 38th mile, it is difficult to find a *diverticulum* at the same point by which it is 3 miles to the right to the springs. Perhaps the original *diverticulum*, as Lanciani supposes, followed the base of the mountains, keeping above the springs, while Nero took his newer Via Sublacensis straight across the plain.⁴

The actual remains begin with concrete walling faced with *opus reticulatum*, behind the railway-station of Marano-Agosta; and other fragments of concrete in the vicinity show that the Roman headings must have extended thus far.⁵ The spring immediately south of the station is now being used for the modern Acqua Marcia, and the map here given (Fig. 6) is made from one kindly placed at my disposal by Signore De Dominicis, the chief engineer.

The first remains of channels are at Rosoline, about 100 m. east of the road to Marano and some 400 m. north-west of the railway station (see Fig. 6). Two parallel concrete channels (13 *a*, *b*), with rounded roofs, were found under road paving, one at 317.04 m., the other at 316.80 m. above sea-level. These channels have been traced at intervals, and reappear (12 *a*, *b*) some 100 m. north-west of the turning; the road was practically at the same level, and the size of the smaller *specus* almost as before; it was not possible to take levels, nor to measure the larger channel. All four conduits evidently belong to one pair of feeders.

of A.D. 317-23, to Constantine, Licinius, Crispus, Constantine II, and Licinius junior. The second stone, on the right of Via Sublacensis, was of A.D. 367-75, to Valentinian I, Valens, and Gratian. The third, on the left of Via Valeria, was also of the fourth century.

¹ The 38th milestone of Via Valeria is noted by Fabretti, 87; 79; *alio probatio habetur ex lapide milliario XXXVIII . . . ad fontem Sommulae, ut Gruterus (155, 4) refert, olim stante*. CIL. ix. 5963. Its original position is placed in Lanciani, 66: 278, at Vigna della Corte, 2,100 paces from the *bivio*. It is a stone of Nerva.

² 84: 92; CIL. ix. 5971: dated to A.D. 103-4.

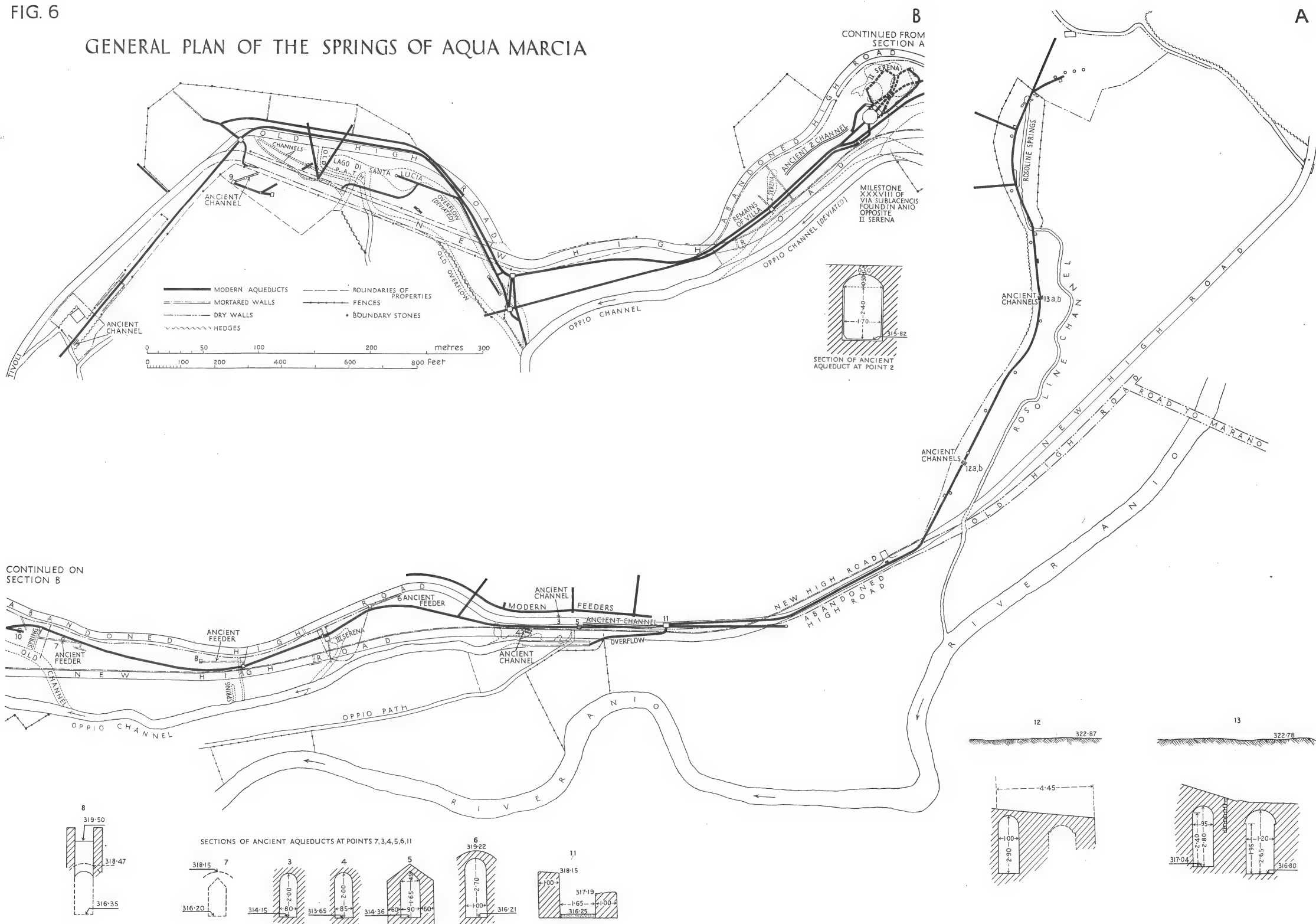
³ *Tribus milliariis stadio minus distantis a bivio dicti viatrii, quod post pontem Anticoli Sublacensem cum Valeria iungit*. Fabretti's *viatrium* is the real Via Valeria.

⁴ Cf. the discrepancy between the official and actual distance between Rome and Tibur, discussed in PBSR. iii. 85-108 ff.; and in *Atti di Tivoli*, cit. ii. 75-8 (= *Via Tiburtina*, 2-5), where I have made it a good deal greater, about a mile and a half between Rome and Tivoli. I have not so far arrived at any satisfactory solution.

⁵ I owe this information to the kindness of Ingegnere Marella, of the Società dell'Acqua Pia Antica Marcia, the water company now working the springs for the City of Rome.

FIG. 6

GENERAL PLAN OF THE SPRINGS OF AQUA MARCIA



Another feeder seems represented by a channel (11) found 250 m. northwards. It was 1.65 m. wide, with concrete walls 1.00 m. thick and at least 1.94 m. high; the cement bottom was levelled at 316.21 m.

A third group, found 60 m. farther on, lies deeper, at 314.36 m. Three successive sections (5, 3, 4) were cut, giving a *specus* 0.90 m. wide and 1.65 m. high, with a roof sometimes round and sometimes pointed. Details are given in the accompanying figure (Fig. 6). This sector ran for 45 m., dropping in level to 313.65 m. *Specus* 6, at 110 m. beyond this group, was levelled at 316.21 m., and must therefore be independent. It lies 70 m. above the third Serena. Independent also is *specus* 8, at 75 m. farther, with its bottom levelled at 316.35 m., and its roof pierced by a *puteus*; but with it appears to go no. 7, of similar size, 160 m. away, at a level of 316.20 m. The place in the scheme of no. 10, situated some 35 m. farther on, at 314.45 m., is uncertain.

We are now at the second Serena; and, about 15 m. below the modern octagonal intake-tower¹ (*Botte dell'Acqua Marcia* on the map), where the aqueduct of 1869 began, a length (2) of 70 m. was found. Its great size suggests either another independent source, or a union of some already described, the level of the bottom being 315.82 m. The end of this stretch of aqueduct is only 30 m. from the first Serena, and it must correspond with the uppermost of the remains described by Lanciani,² which were 91 m. long and ended at the octagonal intake of the second Serena. 'When the foundations of this reservoir were excavated,' he says, 'constructions in rusticated ashlar were found, no doubt intended to collect veins of water.'³

A long interval now follows, reaching to 150 m. below Lago di S. Lucia, or 550 m. below the first Serena. Here the bottom of an ancient aqueduct (9) was levelled at 313.38; and, 200 m. farther on, a level (1) was taken at 313.94 on the bottom of yet another *specus* close to a small house,⁴ the Casetta dei Guardiani,

¹ Attention should be called to Blumenstihl's statement that when the channel of the modern aqueduct was being constructed (which, as is well known, between Arsoli and Tivoli has a series of small falls of the total amount of 111.68 m. in order to get over the difference of 131.23 m. between the springs and the settling tank at Quintiliolo, and maintain in the normal sections the fall of 0.7296 m. per kilometre) 'we saw, to our surprise, that the old aqueduct in its course had the same gradients and the same falls... we found, that is, that in general the levelling corresponded with that given to the new aqueduct.' See *Brevi notizie sull'Acqua Pia*, 110.

² Lanciani, 68: 280.

³ Belgrand (op. cit. 43) quotes a similar statement from Blumenstihl: 'J'ai ordonné', he says, 'de faire des fouilles autour de la 2^e Serena: et en effet nous découvrimus l'ancien aqueduc parfaitement conservé, à très peu de profondeur sous le sol, avec la construction et les dimensions de la Marcia, se dirigeant vers la 2^e Serena.'

⁴ On Lanciani's map (his pl. v) the Casa degli Ingegneri is some 300 m. from the Laghetto di S. Lucia; and it is probably the same as the Casetta delle Forme, the Casa

probably Lanciani's Casetta degli Ingegneri. Lanciani's list, based on vanished landmarks,¹ has now to be fitted into place. His sixth piece, 18 m. long, is described as close to the Casetta delle Forme; his fifth, 6.50 m. long, almost touched the Casa degli Ingegneri.² His fourth, 7.25 m. long, comes at 217 m. farther on, 690 m. from the vanished Osteria della Mola d'Arsoli. His third, 5.50 m. long, lay 180 m. farther on, 510 m. from the Osteria, and its level is calculated by him as 319 m. above sea. This disagrees with all our levels, but agrees with the next two, 318, at 110 m. farther and 54 m. long, and 317,³ between the fork of the Roviano road and the Anticoli bridge of the Anio. Thus, if the levels are correct the last three are either another independent group of channels, or belong to Aqua Claudia: they are the last of possible feeders for the aqueduct. The whole group is not accurately to be defined now, but formed a system of separate feeders later united in one channel, very like the feeders of the modern aqueduct.

(b) *From the springs to Vicovaro. Map 7.*

The *specus* of the main Aqua Marcia, built of rough limestone concrete, was certainly found 730 m. downstream from the Anticoli bridge: it was 2.70 m. high, with a vault 0.60 m. high, and 1.52 wide. *Cippus*⁴ 1197 was found in 1867, while building the modern aqueduct, on the left of the road, almost exactly above this *specus*.

For about a kilometre from this point no part of the aqueduct is to be seen. Then, almost midway between the 51st and 50th kilometre stones, on the north side of the high-road,⁵ a travertine *cippus* is *in situ*; it is 0.60 m. wide, 0.36 m. thick, without inscription, though apparently complete at the top. Near the so-called Acqua

dei Guardiani on our map. According to the table given by Lanciani (64 : 276, nos. ii, iii) the Casetta delle Forme should be some 720 m. from the Laghetto, but there is probably an error here, for his figure 880 (no. ii) is certainly a misprint.

¹ Lanciani, 68 : 280 (cf. 76 : 288) states that he measured the distances 'on the large plans of the Water Company, where the individual remains are drawn', shown him by the chief engineer, Sig. Filonardi. Unluckily, these plans do not appear to be preserved, and inquiries at the Office of the Acqua Marcia have been fruitless. My omission to mark remains of the Aqua Marcia higher than II. 34 was due to the fact that we still hoped to obtain them at the time the map was being made. This failure necessitates a longer description.

² This was $690 + 217 = 907$ m. from the Osteria della Mola d'Arsoli, which must have been near La Moletta on our map (point 329).

³ The first piece was in the district called Terra Rossa; as the map shows, these two places are not more than 125 m. apart; so the description of its situation would suggest that it was quite a short piece: but Lanciani, 75 : 287, gives 860 m. It is apparently in use for the modern aqueduct. It depends on the direction now given to the 860 m. whether *cippus* 1215, found *in situ* 300 m. up-stream of the bridge, or 300 m. down-stream from the fork of Via Valeria and Via Sublacensis, belongs to this stretch or not.

⁴ It was of travertine, 0.50 m. wide (*Bull. Com.*, 1880, p. 18, no. 172).

⁵ To be exact, 25 m. down the valley from the small stone marked V (500 m.).

Solfa, a small piece of the north side of the *specus* in late work¹ is still visible under the road; and it was found at the Acqua Solfa itself, carrying water from a spring. From the 50th kilometre stone onwards the same wall of the *specus* may then be seen in the road,² almost as far as Osteria della Ferrata.³ Here the *specus* is 1.30 m. wide and 2.45 m. high, with a pointed roof another 0.45 m. high, and a quarter-round moulding at the base 0.15 m. high and 0.15 m. wide.⁴

According to Fabretti, an aqueduct was also visible near Osteria della Spiaggia, on the north of the road, which, he thought, might be the Marcia, but which Gori rightly took to be the Claudia. He places this second *osteria* about 11 stadia (1 $\frac{3}{8}$ mile) nearer Rome than the Osteria della Ferrata, a considerable exaggeration; but ever since, there has been⁵ great confusion, except in Cassio (i. 101), between the two. Revillas maps them quite close together. The Carsoli sheet of the Staff Map, which marks them rightly about 200 m. apart, calls the building north of the road *Osteria della Ferrata* in the 1876 edition and *Osteria della Spiaggia* in that of 1911.

Just south-east of Osteria della Spiaggia, on the opposite side of the road, but under and more or less parallel to it, the north wall of the *specus* may again be seen; it is 2.25 m. in height up to the springing, and its width, measurable at one point, is 1.38 m. (ii. 41). The external facing cannot be seen, but the interior of the north wall is in very bad, late *opus mixtum*, which might well belong to the period of Belisarius.⁶ The tiles are curved and very thin; and the blocks of stone are extremely rough. The great similarity in style of construction to the late remains at Acqua Solfa makes it fairly certain that this aqueduct must be the Marcia, not the Claudia.⁷ About 100 m. from the farther side of the bridge is a

¹ For a description of the type of construction see two paragraphs below.

² *Vat. Lat.* 9024, 84, where Revillas notes the point.

³ Fabretti (69. 9: ii, tab. i. 9) notes the existence of a *specus* in the wine-cellar of the Osteria della Ferrata (on the left of the road) which marks the site of the post-station of *Ad Lamnas* on the Via Valeria; and it is also described by Revillas, who notes that it had side-walls faced with brickwork, and measured 9 feet high and 4 $\frac{1}{2}$ feet wide. It is also mentioned by Canina (v. 140) and Gori (*Acqua Marcia*, 72, but placing it at Osteria della Spiaggia).

⁴ A modern house incorporates its left-hand wall at one point.

⁵ 84: 76, *sed ut ad Holstenium redeamus, erroris praecipua illi causa fuit, ignoratio veteris ductus Viae Valeriae, in qua varius, sibi que contrarius existit: nam alicubi, fol. 165, bivium Sublacensis et ab ea divertigium, agnoscit ad Hospitium della Ferrata in quo forte τῆ ἐβροχία litavit; alibi, fol. nempe 35, viam Sublacensem revocaverat ad Hospitium Plagiae, quod xi fere stadiis divertigium antecedit.* For this erroneous theory of Fabretti's—that it diverged at the Osteria della Ferrata and ran west of Monte S. Elia and Riofreddo without making use of either the Ponte Scutonico or the Ponte S. Giorgio—see *Supplementary Papers of the American School at Rome*, i. 130-2).

⁶ Compare a similar piece on the Aqua Claudia in the Podere Saccardo, see p. 240.

⁷ This cannot be the piece which Lanciani (75: 287) saw and described in 1879 as 'almost touching the Osteria della Spiaggia' (really as his map shows, Osteria della Ferrata)

mill, the Mola della Spiaggia or della Scarpa,¹ near the overflow from which Lanciani saw another piece of the aqueduct, 235 m. from the last piece, and 111.50 m. long. This must, like the first, have lain on the right of the road going towards Rome.

Ingegnere Marella informed the author that remains of the Marcia had been found, in making the modern aqueduct, some 5 m. below ground, at a point about 100 m. farther on, to the right of the road, at the crossing of the road between the railway station and village of Cineto Romano. Lanciani saw a piece, 40 m. in length, about 70 m. farther on,² on the left of the road going towards Rome.³

At 200 m. farther on the modern aqueduct cuts across a bend in the high-road, at a place called Il Ceraso. Here remains of the ancient aqueduct were recently⁴ found; and about here another of Lanciani's sectors began, at 530 m. from the mill-overflow, 4,380 m. from Ponte di Anticoli, and 7,680 m. from Laghetto di S. Lucia. This was no less than 1,930 m. in length; it followed the north edge of the curving Via Valeria for 1,030 m., as far as an oil-mill called Le Frattocchie; it then turned at right angles, for 220 m., and at right angles again, running parallel with Via Valeria for 248 m. Hence it ran for another 432 m. towards the Cantalupo⁵ (Mandela) road, crossing it 50 m. from the fork with Via Valeria, and disappearing under the embankment of the Valeria. Since this point is only about 1,850 m. in a straight line from Mola della Scarpa, while the course of the aqueduct was about 2,460 m., it is easy to see how sinuous that course must have been; and it is a great misfortune that the maps on which the remains were marked cannot be found. Nowadays, much less is visible than in 1879—no doubt because the builders of the modern aqueduct used the ancient remains. Some concrete, probably belonging to the bottom of the *specus*, has been seen in a small valley south-west of the disused *casello* 56.257, and west of the remains of the Aqua Claudia in the cutting (II. 40); the level was, at a guess, 306.75 m. The *specus* was also found here, according to Ingegnere Marella,

'and extending towards the bridge of the Via Valeria over the Fosso della Scarpa'; for he notes that Gori, *Acqua Marcia*, 72, attributes it to the Claudia, and adds 'as I do not know the levels, I cannot say that he is wrong'; and indeed in describing the Aqua Claudia (136 : 348) he assigns it to that aqueduct. But the piece to which Gori refers is that which he saw inside the Osteria (*supra*, p. 99, n. 4).

¹ This stream will be found on the western edge of our map. He notes that it lay 3,615 m. from Ponte d'Anticoli, and 6,915 m. from Laghetto di S. Lucia. Lanciani's description of the third piece as on the left of the road going towards Rome (on the right going towards Subiaco) might, however, lead us to suppose that the first and second pieces were on the opposite side.

² It was 280 m. from the overflow of the mill.

³ That is, on the right going towards Subiaco.

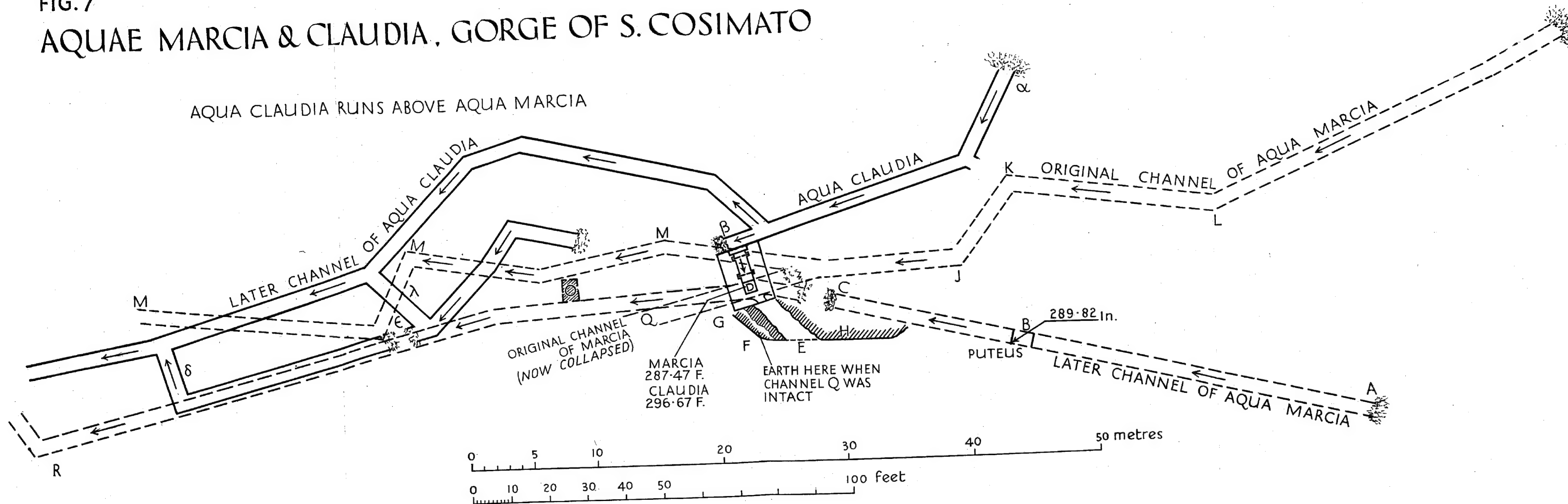
⁴ Information from Ingegnere Marella.

⁵ The road to Cantalupo leaves the Via Valeria at the railway *casello* 55.349.

FIG. 7

AQUAE MARCIA & CLAUDIA, GORGE OF S. COSIMATO

AQUA CLAUDIA RUNS ABOVE AQUA MARCIA



running at an angle to the modern Acqua Marcia. Further remains were seen in 1900, about 100 m. east of the level-crossing at *casello* 55.349, and also 50 m. southwards; but they have disappeared since the branch line was made to Subiaco. The first piece was of concrete faced with reticulate work (perhaps Augustan) about 4.85 m. in total width; but there was also some later work: probably there was a small bridge over the stream. Nearly a kilometre farther down, north-east of *casello* 54.480, the channel was seen in 1900, running side by side with the Claudia between the road and the railway just above the river; it was only 0.85 m. wide, and was lined with late *opus mixtum*. Some 500 m. south of the same *casello*, beginning about 100 m. before the road bridge over Torrente Licenza¹ and extending as far as it, remains (III. 34)² exist of the channel in concrete, running 20° W. of S., with buttresses on each side. The interior of the *specus* is not accessible. The structure formed an approach to a bridge across the stream, of which nothing is left. The earliest part is not later than Agrippa; while restorations by Augustus and Titus (or Hadrian) and late *opus mixtum* may be seen.³ The first piece, under the road, belongs to the left-hand side and is late; between the railway and the road, Agrippa's work is inside and Hadrian's outside. The original aqueduct was about 3 m. wide over all, faced with limestone *opus reticulatum* with stone quoins; its buttresses were 0.90 m. wide, projecting 1.50 m. on the west and over 3 m. on the east. Later buttresses, 1.80 m. wide, in tufa *opus reticulatum* with quoins of the same material, project 1.50 m. on the west.

A gap now extends for more than a kilometre, to the gorge of S. Cosimato, some 200 m. south-west of the upper mouth of the railway tunnel. Here, on the left of the path along the river, close to the water, are scanty remains of the original channel in rubble, exposed and damaged by recent excavations of earth for the dam below. At 50 m. farther on, we see the *specus* walls in large rough limestone blocks, with much deposit between them. This fragment of *specus*, now in the open, must also be part of the original channel. Some 45 m. farther on again, where the true gorge begins, the *specus* (Fig. 7, A) is cut in rock, 1.45 m. wide. The angle is reinforced with brick-faced concrete, which, when first discovered, had external buttresses of the period of Titus or Hadrian. The *specus* here is accessible 28 m. farther on, at B, a *puteus* with lateral opening in the rock, 1.47 m. wide; it has a flat

¹ This name is probably a corruption of *Digentia*; it appears as early as 863, in a Bull of Pope Nicolas I, and applies also to the hill-village; see Lugli, *Mon. Linc.* xxxi. 482-7.

² These remains are wrongly placed on Map 7, as though on the south bank of the stream; and, by an even worse mischance, no remains have been shown farther up-stream.

³ Dr. Van Deman's dating.

rock roof, with sides of rough concrete, 1.14 m. wide. The *puteus* was at first rock-cut and later lined (probably by Titus) with brick-faced concrete walls on the front and east side (0.60 and 0.70 m. thick respectively); it was thus narrowed to about 0.90 m. wide. On the inner side of the front wall is a foot-hole 0.14 m. wide to facilitate descent into the *specus*. The level of the uppermost course of bricks of this wall is 290.17 m.; and the intrados of the *specus*, with pointed roof, is 0.35 m. lower, or 289.82 m. At 18 m. from the *puteus* there is a break (C), but the *specus*, now flat-roofed again, 1.03 m. wide and some 1.80 m. high, almost immediately reappears, running at an angle into a sluice-tower¹ (D). This was probably at first a *puteus*, 1.20 m. by 1.08 m. wide; later, a sluice was opened into the Aqua Claudia, running above. The difference in level between the bases of the two channels is about 9.20 m., the Marcia having been levelled at 287.47 m. The brick-faced concrete at the bottom of the shaft, connected with *specus* C, is of the period of Titus. The original *specus* (J-K-L) ran straight across the shaft, and can be followed upstream for some 60 m., until blocked by a fall of earth.² A little of the roof is flat concrete, set on planks: most is cut in the rock,³ 2.30 m. high and 1.20 m. wide. The loop-line M M M seems to have been designed to cut out D, when this was necessary. The external walls of the tower seem to belong to two different periods: the first (F) had no external facing, being built against earth; the second (G) was inserted against F after the earth had been removed, and faced externally with Hadrianic brickwork; and at the same time a brick arch at the break-through of the modern entrance to the *specus* was almost completely removed to make room for a gabled roof. The external embanking wall on the right (H) belongs to the same period. The 'passage' is 2.15 m. in length and 1.48 m. in width; a threshold block of travertine 1.56 m. long (and therefore too long to have fitted into the sluice-tower), made for a door 1.36 m. wide with a slit cut in it 0.09 m. across, lies not far away.

Immediately on leaving the tower, the main *specus* of the Marcia is no less than 3.30 m. high and 1.14 m. wide; it had been excavated as near to the edge of the cliff as was possible, but has collapsed in places, especially between Q and R, where it was later blocked by concrete walls. A new *specus* was then built

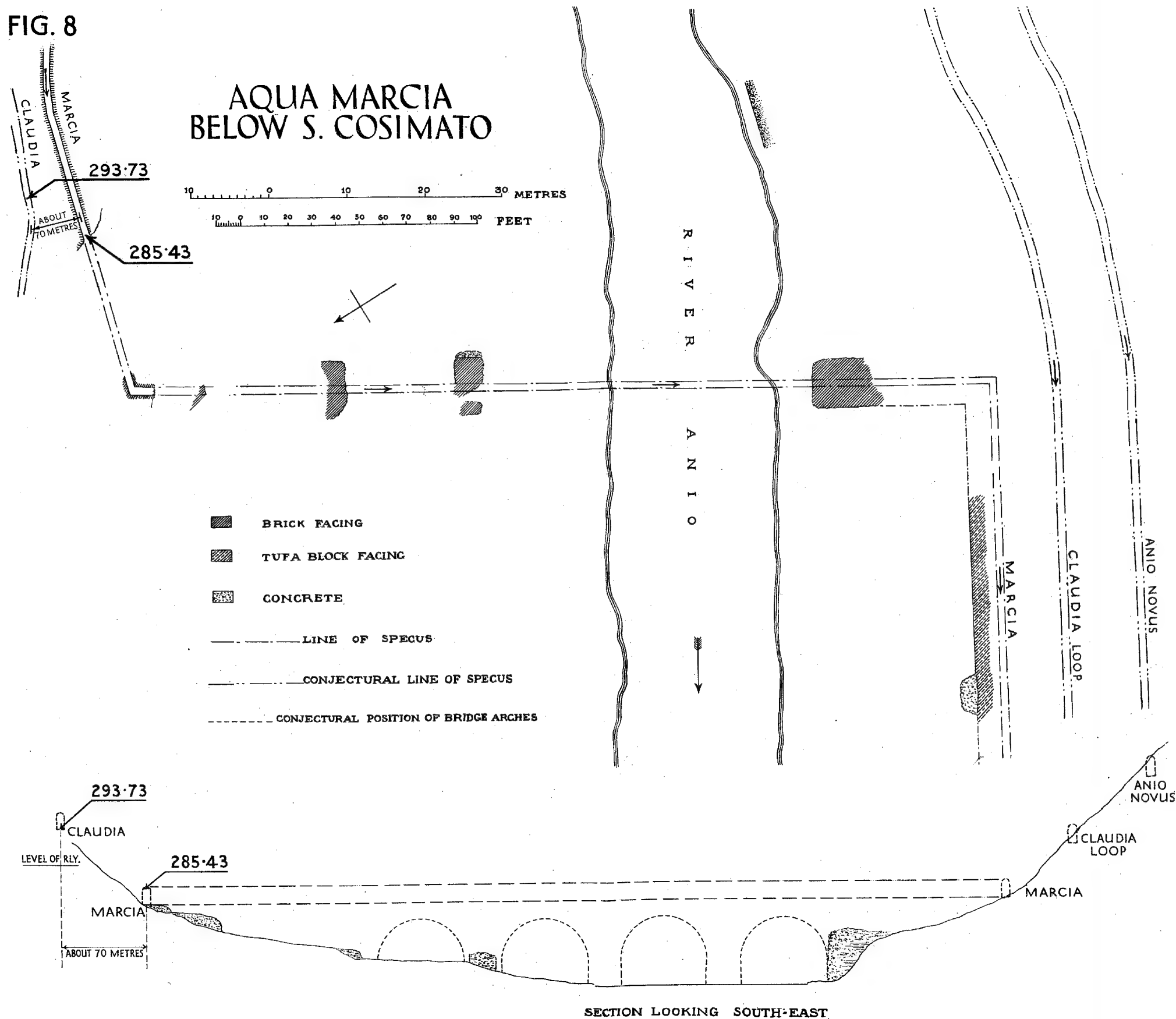
¹ Now accessible by the modern opening, E.

² This particular stretch of the channel of Aqua Marcia was known and visited comparatively early. Near the innermost extremity I copied two inscriptions; *A di 12 di febrajo 1557 Matteo dall'Abadia di sto Salvatore*; and *a di 9 8bre 1672 Pietro Antonio Forzanetti d Oleuano*; the earliest date was 1546.

³ The top is quite flat, and the *specus* only about 1.50 m. high: and where the rock has fissures, it may be seen about 4 m. above, no regular roof having been constructed.

FIG. 8

AQUA MARCIA BELOW S. COSIMATO



further in, which has a break at *e*. At O, a channel is cut back towards the inner branch (M M M), without quite reaching it, and is roughly and badly filled: and just beyond there is some reinforcement in brick low down in the main channel. At P there was a circular shaft. The *specus* soon diminishes considerably in size, measuring only 2.20 by 1.02 m.¹

Some 20 m. below R, by the old mill-sluice tower (Pl. II *b*) a rectangular shaft with foot-holes led into the *specus* from above; it is cut in the rock, and can be seen to curve over after an ascent of about 10 m., so that it was no doubt reached from the side by a window-like opening, at this level. How external access was then gained we can only conjecture—whether by rock-cut steps or a path, or by a ladder.² The facts that only in this gorge have the channels been completely cleared of deposit for a considerable length, and that they are inscribed with a variety of seventeenth- and eighteenth-century³ names, especially in one of the branches of the Marcia, seem to show that this must be the place alluded to by Donati⁴ as that where ‘new stone quarries have been found in the subterranean channel of the Aqua Claudia. For . . . moisture . . . has percolated into it, and become mixed with sand and hardened in this cold damp place: so that a new stone like alabaster has formed in a huge mass, which in process of time has filled the whole length of the channels. Quarries have been started, and it has already begun to be extracted; it is brought to the city, and highly polished, and is used for the decoration of altars. Although the stonecutters observe that a rough stone will not take the highest polish, yet it meets with approval even among the splendour of the glittering marbles of the churches of Rome.’ Cassio⁵ describes the deposit in this portion of the *specus* as extremely thick, with no less than 24 different strata, showing the length of time during which it flowed.

The making of the modern electric dam cut through the *specus* of the Marcia, now visible just below it, with a branch going off at right-angles into the rock, but inaccessible when our plan was made. Still lower down are two rock-cut channels, connected with the old mill, of which the picturesque dam (Pl. II *b*) was only constructed in 1848. Nearly 40 m. farther down-stream there is a window in the side of the rock-cut *specus*, which now opens

¹ *Builder*, 89.

² *Livellazione*, p. 66, immediately after III. 33. Below this a gabled channel, cut in the rock, 0.63 m. wide, goes in straight ENE. for some 20 m., and is then blocked. Probably it has no connexion with the aqueducts, as it is too small and too low for either the Marcia or the Claudia. Its intrados is at 285.12 m.

³ In the stretch C–D may be read: M. Ant. Boldeti SS. Coemeteriorū urbis Custos. | Caietanus Ridolfi | Joēs Marangonus sec. 13 Oct. 1714. The first and last names are well known to all archaeologists.

⁴ *Roma Vetus ac Recens* (ed. i, 1638), 291.

⁵ i. 71; cf. *Lanciani*, 76 : 288.

about 1 m. above the bottom.¹ Forty-five metres still farther down the *specus* is blocked by a modern wall, and a break occurs; after which the *specus* begins again and runs straight for the same distance, when it is closed by a modern door (III. 33),² and is soon blocked.

The aqueduct is not seen again until after it has passed under the bridge of the Aqua Claudia at the Madonnella (II. 36, &c.). Here, a little way up the path leading to the road, its north wall, in concrete seemingly Augustan, may yet be seen; it then disappears under the path: but its underground channel, slightly winding, has been followed back for a length of 215 m. from an opening in the hill-side, some 20 m. before it turned to cross the river.³ This opening is blocked by a wall. The *specus* (285.43 m.) was found to measure from 1.70 to 2.00 m. to the springing of the rounded roof, about 0.50 m. high; it was 0.80 m. wide between quarter-round mouldings, and 1.10 m. wide higher up. Where the *specus* is cut through the solid rock, the roof has been lined with cement; while holes cut to extract material revealed a concrete vault set on planking, as also at the lower end of the sector. The character of the construction suggests the period of Hadrian. After the aqueduct emerges, the facing is in Augustan *opus reticulatum*; and this continues until after it has turned at half a right angle, in preparation for crossing the Anio by a bridge,⁴ where is a small piece of Flavian work. The bridge is Hadrianic; its very scanty remains (Fig. 8) consist of the abutments and one pier, now on the right bank. The two piers in the river have completely disappeared; but a block of rough travertine on the left bank in the water, and one or two more on the right bank, may have belonged to the arch.

After crossing the bridge,⁵ the aqueduct turned at right angles and ran along the left bank of the Anio. The *specus* is seen almost at once, almost opposite the bridge over the railway, at the lower end of the tunnel; it is a late hill-side channel (III. 31, 282.44 m.).

¹ The channel does not seem, from the deposit, to have normally been quite full; when it was so, there must of course have been some way of closing it.

² A rock-cut channel below it was levelled at 284.98 m. but, again, probably had no connexion with the aqueducts. The Marcia's intrados lay at 288.68 m.

³ *Builder*, 90. It is possible that the 'other channel on the right bank, close to the path, only 0.70 m. in width, covered by two blocks of stone (each 0.20 m. thick) inclined to form a pointed roof' of which I spoke in this passage, was the original *specus* of the Marcia; but it was not connected with the later channel and has now disappeared.

⁴ Previous writers supposed that it crossed at the lower end of the gorge, by the bridge which was in fact built by Hadrian for a branch of the Claudia; see p. 197.

⁵ In Terreno Perozzi, the vineyard on the south bank, a peasant related the story of Nero and the aqueducts in a curious form. Nero built seven aqueducts to flood Rome, boasting that he had done so in despite of God:

'se lo voglia o non lo voglia Iddio,
L'acqua l'ho portata al Campidoglio'

The aqueducts then burst, and Rome was safe. Cf., however, the Sibylline tradition, p. 88.

Then follows a supporting wall of concrete faced with small blocks of tufa. The *specus* is next seen in an orchard, some 100 m. upstream of the lower mouth of the Galleria S. Cosimato of the power channel,¹ to the right of the path leading along the left side of the valley; it is in rough unfaced concrete of uncertain date, with a round roof. The writer saw yet another piece in 1900, below a sector of the Anio Novus (I. 61): it was round-topped and 1 m. wide, constructed of rough concrete.

Henceforward the Aqua Marcia,² like the Claudia's later branch and the Anio Novus, must have followed the river fairly closely; indeed, the engineers of those aqueducts no doubt took it as their guide. But it ran at a low level, without prominent constructions, and the modern power-conduit has obliterated almost entirely what remains. In building the conduit the Marcia was found more than once, after our levelling was completed. In one place,³ the writer saw it directly under the conduit: it had buttresses faced with brick and *opus reticulatum*, assignable to Hadrian, and at one point measured 0.90 m. wide, with a gabled roof. A piece of the channel, also faced with *opus reticulatum*, which lay about 6 m. above the river, down-stream of a conspicuous rock just east of the railway-bridge, has disappeared. Opposite *casello* 51.333, a round hole roughly cut in the rock, about 0.87 m. in diameter, may be a shaft leading into the aqueduct.

(c) *From Vicovaro to Tivoli. Maps 5, 6, 7.*

Beyond the railway station of Vicovaro and *casello* 50.351, the *specus* (III. 30) is visible at the little Fosso le Giunte. It is just below the railway line, which runs parallel to it (i.e. 30° S. of W.); and its south-east wall serves to support a path. Each side wall is built in three large courses of travertine, and the tufa vault is turned in two large springers and three small voussoirs; this is certainly original work. To the north-east of the small bridge (*caposaldo* 230 *bis*) by which the railway crosses Fosso Salone a *puteus* of *opus mixtum*, 1.90 m. square over all, gives the direction as south-west. Some concrete, perhaps part of the channel, is visible in the right bank of the stream. On the left bank, the *specus* (III. 29) could be seen in 1915 in the ditch by the railway. It was running parallel to the railway, and belonged to the original aqueduct, though somewhat different from the last piece:⁴ its

¹ Not far from I. 62.

² The bridge attributed to the Marcia in *Builder*, 90, col. 3, belongs really to the Claudia (near II. 35, and not far below I. 60).

³ Not far from a piece of concrete which I wrongly attributed to the Anio Vetus before I knew the real position of its intake. This piece of concrete is unfaced, and belongs to a late period; it is only about 3 m. above the river level, and is probably a supporting wall for the hill-side. *Builder*, 90.

⁴ The drawing of it in *Livellazione* (fig. 53) does not represent the *specus* quite correctly.

sides were of small limestone rubble, and the roof of two inclined slabs, above which rough Augustan concrete had been added. In 1927 this piece had disappeared. The stream opposite the tomb of Maenius Bassus on Via Valeria¹ was crossed below the bridges of the Anio Novus (I. 54) and Claudia (II. 29) by a small one-arched bridge, with abutments of Augustan concrete, faced with *opus reticulatum* (III. 28).

No trace of Aqua Marcia appears for nearly a kilometre and a half, until, almost due east of the railway station of Castelmadama, the Fosso Vallana unites with a nameless group of streamlets from Piano Maiura. Below the confluence lies a concrete bridge of the Aqua Marcia (Fig. 9),² faced with *opus reticulatum* quoined in brick and buttressed in small tufa blocks and bricks. Ashlar was used only at the points of greatest stress, resting on concrete foundations of dark-gray tufa. At the north-west end of the south-west side the *opus reticulatum* is quoined in stone, and there are builders' joints inside the brick-lined specus at *a*; on the north-east side, shown in our elevation, no change in style is visible. In fact, the whole bridge is a homogeneous work attributed by Dr. Van Deman to Hadrian. The central portion over the stream has fallen, taking with it the arches³ but leaving the spring of a small one in brick on the north-west bank. The *specus* is of considerable height, some 2.70 m. from the bottom to the impost, while the intrados of the pointed roof, retaining clear impressions of planks 0.30 wide, is 0.96 m. higher (III. 27),⁴ making a total of no less than 3.66 m: its width increases from 0.90 to 1.10 m. at the upper end of the bridge. On the north-west side of the stream is an inspection-shaft (A), no doubt reached by the stairs against a buttress on the south-west side. A shaft in a similar position may be seen in Ponte delle Forme Rotte of Aqua Claudia (Fig. 20).

Immediately south of the bridge, a fair length of aqueduct may be seen running along a hedgerow below the field-path which leads to the next valley, of the Fosso della Noce. Its south end is about 150 m. north of the remains of the Anio Novus, to the north-east of Costa di Colle Mare. It is a hill-side channel, of rough concrete with buttresses. The scanty remains of the Aqua Marcia in Fosso della Noce (III. 26) are considered below.⁵

Nothing has ever been seen of Aqua Marcia in the kilometre between Fosso della Noce and Fonte Luca, even though the Anio Vetus was found in building the Alessandro Volta power-

¹ It is on the north edge of the Castelmadama map sheet, called *Sepolcro Basso*.

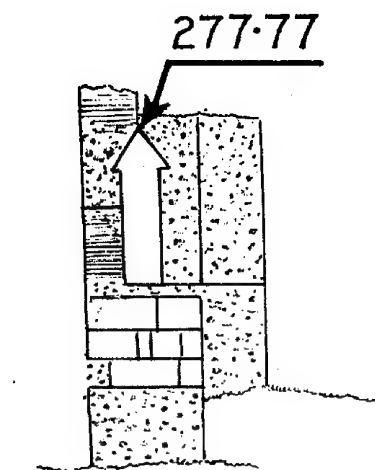
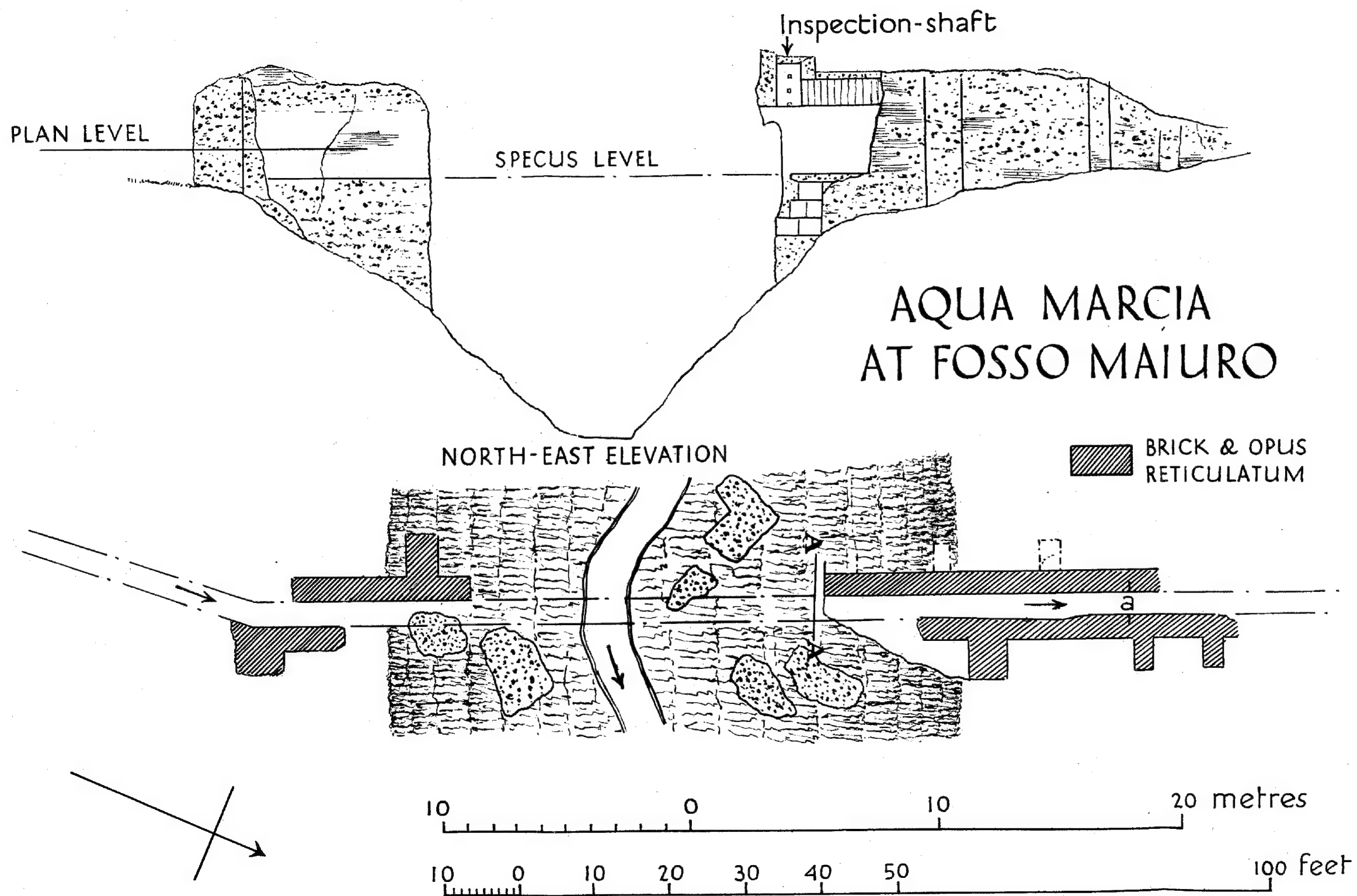
² In *Builder*, III, it is wrongly attributed to the Aqua Claudia.

³ The central one may have been of stone.

⁴ In *Livellazione* the fall has been underestimated as 1.24‰, the exceptional height of the *specus* not having been taken into account. The intrados is at 277.77 m.

⁵ p. 206.

FIG. 9



station. At Fonte Luca, in the past, a pier of a bridge of the Marcia, in tufa ashlar, could be seen on the south-west bank of the stream, with traces of a *specus*, in rough tufa blocks, on the north-east bank. This lay just north-west of the Claudia's bridge (III. 25). The *specus*, lined with brickwork, could also be seen in the little tributary to the west. Neither piece appears now.

Round the steep eastern slopes of Monte Papese the aqueducts all keep underground, the Anio Vetus being the first to emerge. Aqua Marcia appears shortly after *caposaldo* 225, and runs just above the path, high above the river, for a long way, unfortunately omitted in the *Livellazione*. The intrados of the unlined *specus*, 0.04 m. wide, with a pointed roof, is visible at several points, and the *opus reticulatum* with tufa quoins of the exterior justifies its attribution to Augustus. It may be traced almost all the way round the north point of Monte Papese; and a level was taken on the intrados at a point facing Ponte Fiumerotto and *casello* 45.952¹ as 255.47 m. (III. 24). This is over 1 m. higher than the intrados of the Anio Vetus near *caposaldo* 225 (IV. 12), with which it cannot therefore be confused.

At point III. 24 the *specus* is lined with Hadrianic² brickwork and pierced by a *puteus* 0.90 m. square, in which grows a fig-tree. Point II. 23 is immediately above it. The intrados is also to be seen in the next field, some 75 m. farther on, where the brick impost was levelled³ at 253.98. Above the dam for the Tivoli power-station, some original construction is seen, with a gable roof of tufa slabs, and sides of concrete. Here the intrados was levelled³ at 252.72 m.; the roof had been reinforced externally with Augustan concrete 0.90 m. thick, as at III. 22. Here was a shaft 1.00 m. in diameter. A small portion of the side of the brick-lined channel, of Dr. Van Deman's Hadrianic type, is also visible on the path leading down to the dam itself.

After the dam, the Marcia is seen running along the hill-side, opposite *casello* 44.836. At about 100 m., the original *specus* appears, roofed, as before, with two blocks of tufa inclined to form a gable, and lined with small blocks of limestone, a good deal more carefully cut than those of the Anio Vetus at *caposaldo* 225; they are generally coursed, but a larger block often occupies the height of two.⁴ Somewhat farther on, a little after II. 21, and about

¹ This lies to the west of the hill marked 292.

² Dr. Van Deman's classification.

³ *Livellazione*, p. 57 *fin.*

⁴ I am not clear as to the point at which the level of the bottom of the *specus* reading 251.33 m. was obtained (III. 23) nor whether it was really the bottom, as I have not been able to find it again. The difference between the intrados and bottom measurements taken hereabouts on the Claudia (II. 22) is 3.01 m., and indicates that the second measurement was taken only a little way *down-stream*, as the height of the *specus* is about 2.05 m. in this section. The difference on the Marcia is only $252.72 - 251.33 = 1.39$ m.; which seems to show that it was an *intrados* measurement, taken considerably farther down-stream.

500 m. south-west of the dam, there is a tiny stream in which the *specus* appears once more. The original side wall and pointed roof, all in tufa, are visible: the roof has subsequently been protected by a covering of concrete faced with Hadrianic brickwork. Above it runs the Claudia.

The vineyards now begin. In the first of them is a portion of the external wall of the *specus*, in late concrete of rough pieces of tufa and limestone, supported by five contemporary buttresses, the whole faced with late brickwork. Farther on, the intrados becomes visible, and there is good brickwork on the internal wall, of the Flavian or Hadrianic period.

To the west of Monte Papese, in the path (Map 6) which descends to the Anio, the original *specus* of the Marcia is once more visible (III. 22), running 40° W. of N. It is of rough tufa blocks inside and rough concrete outside, the side walls being 0.75 m. thick and the deposit foul. It had a gable roof in stone, protected outside by Augustan concrete, as noted before. The aqueduct followed the curve of the Anio all the way round, as did the Anio Vetus.¹ Due east of S. Polo station it can be traced for some 500 m., first appearing as Augustan concrete, under a hedge, going 20° E. of S., and then, near a gate close to the angle of a field-wall that runs down to the river, exhibiting the tufa blocks of the gable, running SW. by S. along the hillside, at ground-level (III. 21). In 1911, a *specus* was visible some 500 m. still farther south, running 15° W. of S., close to the Fontanile east of Casa Maria² (*caposaldo* 221): it had been discovered in making a fence, and was used to bring water to the modern fountain. Its position and level suggest that it was a further sector of the Marcia rather than the Anio Vetus, though the foul deposit perhaps favours the latter. But it was not to be seen in 1915, and therefore could not be levelled, nor was it traceable in 1928.

From this point southwards there is no trace of any aqueduct for nearly a mile, until a small stream is reached, almost due W. of the summit of Colle Monitola, near the elevation marked 250 m. on the extreme west edge of the Castelmadama map-sheet. Here a *specus*, now concealed by an impenetrable thorn-brake, was visible many years ago: it was 0.92 m. wide, and built of blocks of tufa 0.50 m. high, evidently of Republican construction. The writer estimated its level at about 250 m., which would suit either the Anio Vetus³ or the Marcia, with a preference for the latter.

¹ For a *puteus* which may belong to either, cf. *supra*, p. 61.

² See below, p. 208.

³ I attributed it to this in *Builder*, 111. The course of both aqueducts is indicated too far east on the map.

Some concrete, however, lies above it, going 20° S. of W.; and if this belongs to the Marcia, the *specus* belongs to the Anio Vetus. Much deposit was visible on the east bank of the stream.¹ Some 600 m. farther west, about 200 yards north of *caposaldo* 213, on the east edge of the Tivoli map sheet, a natural terrace lies above the Anio and below the south-west tip of Colle Monitola. Here is a solid mass of deposit resting on the bottom of the *specus*. About 3 m. of it are preserved, going WSW., followed by a sharp turn to the SSW., and a sector 9 m. long. To the Aqua Marcia may also go a small portion of round-headed concrete *specus*, seen by the writer in April 1900, in a field north of the Anio Novus, between I. 38 and I. 37. The intrados was at ground-level, and it seemed that the bottom might be not much less than 10 m. below the Anio Novus. It was running south-west and was said to be traceable for about a kilometre back.

The Aqua Marcia now begins to run on a low substructure of concrete faced with *opus reticulatum*, which extends for some 65 m. (Fig. 1) and is, according to Dr. Van Deman's scheme of periods, part of Agrippa's restoration. Two buttresses are preserved, both on the south-east side. Arches were seen under the lower part of it but are no longer visible. The *specus* wall is 0.90 m. thick, but its width cannot be measured, and the bottom (III. 19) was levelled at 241.18 m.² The substructure led on to eleven higher arches, not all actually preserved.³ They are built of concrete faced with Flavian *opus reticulatum*, tufa quoins and brick bands; the seventh arch has been restored with tile voussoirs at a later period. The arch over the stream has completely collapsed. On the west bank, however, concrete foundations carry an Augustan concrete core, once faced completely in tufa ashlar.⁴ This suggests that there were several stone arches, terminating with that (Pl. III a) under which the modern road passes.⁵ This arch⁶ is 5.75 m. in span,⁷ with piers 3.80 m. thick; but the span was narrowed in the Flavian period by brick-faced concrete underpinning, still leaving

¹ In a small stream between these two points, on the line of a boundary wall (opposite the hill marked 257 on the farther bank of the Anio) I saw in 1911 a *specus* 0.85 m. wide in ashlar masonry of tufa, with a gable roof of two slabs, running south-east. This also probably belonged to Aqua Marcia, but has since disappeared.

² 240.18 (*Livellazione*, p. 51) will not agree with the measurement on the other bank, and must therefore be a misprint; unless indeed the level was taken *below* the bottom—for the bit on the other bank is *higher*, as far as the eye can judge.

³ Only the first and second and the seventh and eighth, as the plan (Fig. 1) shows.

⁴ These are at slightly different orientations; probably there were slight turns, inserted with the object of reducing the speed of the current.

⁵ As we have already seen, it follows an ancient line up to this point, crossing by a bridge immediately to the south (*supra*, p. 61).

⁶ *Lanciani*, 45 : 257, 78 : 290, pl. iii. 2, a-d; Canina, v. 143, vi. 144.

⁷ The full width was not available for the road, owing to the presence of the channel of the Anio Vetus.

an aperture of rather less than 3 m. The bottom of the *specus* on the arch was levelled at 241.04 m., 5.35 m. above ground-level.

The Marcia now turns at right angles, and continues to run along the hill-side. It may be seen above the road, partly cut in rock and lined with concrete walls 0.60 to 0.70 m. thick, the nearer exhibiting Augustan *opus reticulatum*. Its dimensions vary greatly, but it is at first 1.10 to 1.13 m. wide, and over 2 m. high, with a cement lining 0.015 m. thick. In a new quarry, just before the path ascending Monte Arcese,¹ it is 1.30 m. wide. The deposit is surprisingly foul for the Marcia. Some 60 m. farther on, the *specus* is seen again.²

Before reaching the small Fosso Arcese, the *specus* was 1.00 m. wide, with a vaulted roof 1.26 m. thick, covered by hydraulic cement, 0.05 m. thick, explicable either as the floor of a small cistern, or a protective covering. There was certainly a small tank, perhaps a distributing chamber, at the side, with a cement floor, 0.52 m. wide, bounded by a wall faced in *opus reticulatum*.

On the west bank of this stream, behind the house formerly called Osteria delle Fornaci, near a stable (*rimessa*), and not more than 50 m. below the bridge of the Anio Novus (I. 34), there is a piece of the original channel with a round roof of rough rubble (III. 18). A little nearer the Anio Novus there was a concrete shaft, 1.10 by 1.80 m., lined with Augustan *opus reticulatum*, which may have supplied water from the Anio Novus to Aqua Marcia, if necessary; it had very hard crystalline deposit all round it, 0.30 m. thick, and has now been filled in. Still farther west, below the Casa colonica Luciani (*caposaldo* 207), the concrete channel is seen again. It is higher than point III. 18, which suggests that it is a later restoration. It appears again, some 600 m. to the west, behind the large semicircular projection on the south of the west half of the Tivoli cemetery,³ and may be seen in the ditch on each side of this projection. It is running almost parallel to the long axis of the cemetery itself (III. 17). The *specus* was built in cut-and-cover work, lined with unfaced concrete.⁴ A house on the north-east edge of the path, some 200 m. westwards, at *caposaldo* 206,

¹ *Livellazione*, p. 52, fig. 39. Floor at 239.49 m.

² *Lanciani*, pl. iii, fig. c. See his *Destruction of Ancient Rome*, p. 81, fig. 15, for a section of the *specus* taken at the foot of Monte Arcese in May, 1881. It was 1.01 m. wide, and 2.05 m. high to the spring of the vault, which was 0.50 m. high, giving a total height of 2.55 m. The *specus* was so much blocked with deposit that an opening 2.15 m. high and 0.31 m. wide was all that was left. The *specus* was lined with *opus incertum*. He gives its level as 246.00 (see his pl. iii, fig. c), which is excessive, and taken no doubt from the road-engineer's levels.

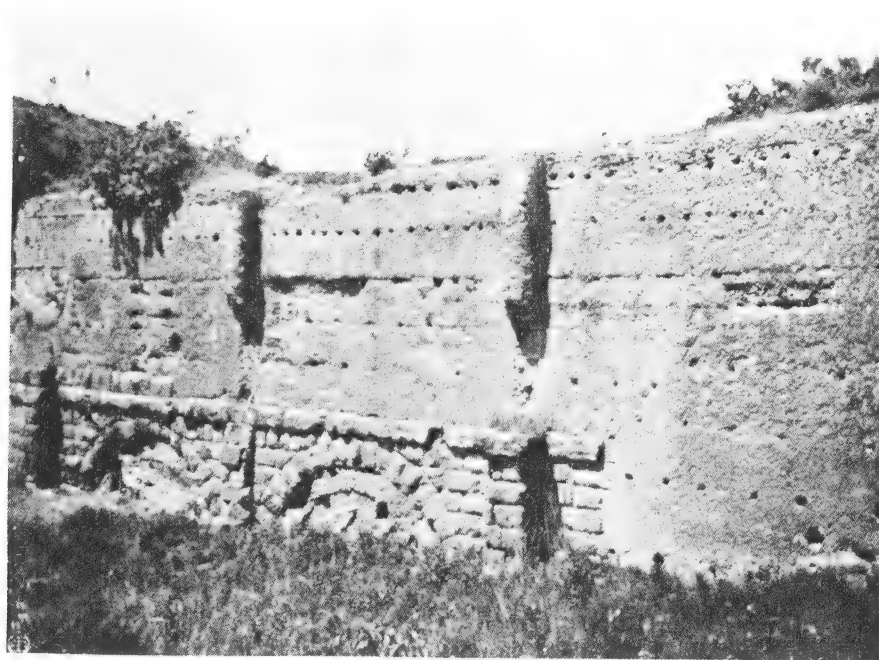
³ A 'well or cistern', found in the old cemetery, in 1926, near its south side and filled in again, may have belonged to this aqueduct. I owe this information to Sig. Pacifici, who obtained it from the custodian of the cemetery. Intrados at 237.39 m.

⁴ A modern shaft about 50 yards farther on, in a field near a ruined house, probably at one time communicated with the *specus*, but has been partially filled up.

PLATE III



a. AQUA MARCIA: PONTE DEGLI ARCI, TIVOLI



b. AQUA MARCIA: PONTE LUPO, UPPER LEVEL, EAST SIDE

has a well which probably communicates with the *specus*. Lanciani¹ also noticed part of the *specus* a little way to south-east of the church of the Madonna dell'Acquaregna, at about 4 m. above the modern road; but nothing is now visible.

The *specus* next appears in the vineyard of the Fratelli Conti, under its upper boundary bank, which runs parallel to the road at about 150 m. away (III. 16, 236·70). This piece, about 60 m. long, is in concrete, faced with brick and *opus reticulatum*, of the finest Hadrianic work. The outer *specus* wall, 0·76 m. thick, is supported by buttresses 1·03 m. wide and 4·06 m. apart, and there is a pointed roof, 0·93 m. high. A hole, 0·30 m. in diameter, for a branch pipe, occurs 0·43 m. below the impost. The branch to the Villa of Vopiscus must have begun hereabouts.² According to Statius,³ the supply was taken by a lead pipe across the Anio; and this is about the nearest point to the villa, which lay just above the waterfall⁴, near the modern tunnels.

(d) *Tivoli to Ponte Lupo. Maps 4, 5.*

The Marcia does not reappear until we have rounded Colle Ripoli, but it ran between that hill and Tivoli Castle, built by Pius II. Like the other aqueducts, it runs southward along the western slopes of Colle Ripoli and Monte S. Angelo in Arcese. A round-headed *specus* of rough concrete, running parallel to the modern high road to Rome and just below it, under a small culvert opposite the Riformatorio, has been rightly assigned to the Aqua Marcia.⁵ The interior is no longer visible, but the concrete was seen in the culvert, and the level (234·17 m.) confirms the attribution.

About 300 m. to the south of Tivoli, below Via di Carciano and above the road to Rome, in an olive-yard belonging to Sig. Fumaroli, a travertine *cippus* (0·64 by 0·55 by 0·25 m.) was found

¹ *Sched. Vat.* 37, f. 30.

² Earlier writers are vague as to the portion just discussed. Raffaele del Re (116 ff.) says it passed *under* the cemetery: this was the account given me, but the information must have referred to the Anio Vetus. It reappeared close to the Madonna dell'Acquaregna. Cassio (i. 105) notes the discovery of a *specus* south of the Strada dell'Acquaregna in a vineyard near the church, called Sugliardi; it was 7 palms wide and 12 high and ran parallel to the road. Close by was a round *piscina*, 12 palms in diameter, from which issued a *specus* of tiles 4 palms wide and 6 high (0·88 by 1·32 m.) running straight across the high road. The name Sugliardi is given by Antonio del Re (1611), who says that 25 years before some lead pipes had been found in it. This must be the Vigna Conti (III. 16). Cassio also notes (i. 106) the existence of the bed of an aqueduct in Tivoli itself, in the Contrada dell'Inversata; which some called the Marcia, while others maintained that it was at too high a level. Finally, Canina (v. 144) notes the discovery of the Marcia at St. Anna, below the Contrada dell'Inversata. This is a branch of Via Colsereno, and Del Re (*cit.*) attributes the remains to the Anio Vetus. I visited a cellar of the Casa Colonna at no. 29 Via del Colsereno, but saw no remains of any aqueduct *specus*: 'the house of the late Salvatore Benedetti at the Arco del Trevio', I could not identify.

³ *Silv.* i. 3. 66. *Teque, per obliquum penitus quae laberis amnem, Marcia, et audaci transcurris flumina plumbo.*

⁴ *PBSR.* iii. 164.

⁵ Raffaele del Re, *cit.*

in 1892, bearing the usual inscription of Augustus and the number 816. Though not actually *in situ*, it is not likely to have been moved far from its original position; and its discovery is of importance, since it shows that *cippus* 823, copied in the church of S. Francesco by Ligorio,¹ must also have stood not far away from that church.²

The *specus* has recently been brought to light in quarrying about 30 m. north of a flight of steps connecting the Rome and Carciano roads, about 50 m. north of the north gate of Villa Braschi, behind the Villa of Signor Lorenzo Magni. It is at first seen coming out from the hill-side almost at right angles, the direction being 20° N. of W.; but it soon turns back to follow the contours and runs 25° S. of W., though it must have turned farther south very soon. It emerges from rock, and is then, according to Dr. Van Deman, built in Augustan concrete. It soon disappears, having probably collapsed long ago.

The next section is in the large quarry below Villa Braschi, where the Anio Vetus was also seen and levelled (IV. 10), about half-way up the slope between the two roads. It is built in Augustan concrete with a round-topped roof, in which the big rough original voussoirs have been incorporated; the side walls are 0.60 m. thick. Other concrete walls a little higher up belong to a channel descending from the Claudia.³ A few metres below the Strada di Carciano, just beyond the south angle of Villa Braschi, by the base of a large electric-power post, a level was taken on what was believed to be the bottom⁴ of the *specus* at 233.54 m. (III. 15); and a length of some 28 m. was discovered in 1926, immediately south of this post in digging the foundations of a villa, in land belonging to Sig. Antonio Sciarretta. It was rectangular in section (1.60 by 0.90 m.), the sides being built of small pieces of local limestone, and the roof formed of single blocks of blackish tufa, measuring 1.30 by 0.78 by 0.30 m. This is original work; but a little before the end of the portion cleared, the flat roof was replaced by an Augustan pointed roof of concrete. An early *as*, with the double head of Janus on the obverse, and the prow of a ship with the legend 'Roma' on the reverse, was found in the upper part of the walling, and is dated to before 264 B.C. by Gatti,⁵ who therefore attributes the *specus* to the Anio

¹ *CIL*. vi. 31562 a. In his Turin MS. Ligorio states that it was removed to the Villa d'Este; 'fortasse fraude', adds *CIL*.

² 240 by 7 = 1,680 feet = 562 m. If the '300 metres south of Tivoli' begin at the Riformatorio, it would have stood quite near S. Francesco. The similarity of number also inclines me to attribute to Aqua Marcia *cippus* 803, noted by Lupi as 'in un travertino vicino a Tivoli': for the only *cippus* of Anio Vetus found hereabouts, in the district of Carciano, bears the number 901.

³ See p. 210.

⁴ Whether it was so is rendered doubtful by the next section, afterwards discovered.

⁵ *Not. Scavi*, 1926, 421.

Vetus: but its position and level give it quite certainly to the Marcia.

Going southwards from the Collegio Irlandese, along the Via di Carciano, immediately before the fork of the road to S. Gregorio, part of the extrados of the channel appears, in Augustan concrete; and, immediately after the fork, the intrados was levelled at 230.44 m.¹ A few yards farther on is an ancient tomb, recently much damaged. It was of especial note, for the winding channel of the aqueduct, cut in the rock, could be seen immediately behind it, and had aroused the attention and interest of many of the writers on Tivoli.² The intrados was here levelled at 230.44 m., being 2.40 high and 1.20 wide; and it was photographed by Mr. Swain before being covered up. The traces of the channel which used to be visible in the path are no longer to be seen. But some 20 m. to the south, in the olive-yard, the original channel appears, partly cut in the rock. It is roofed in one place with large rough slabs of local limestone, but usually with roughly cut voussoirs. This channel may be traced, with breaks, all round the little valley³ above the ruined chapel of the Madonna del Padre Michele.⁴ Restorations by Augustus and Titus may also be noticed: to the latter is due a concrete hill-side channel with buttresses, on the south side of the valley, and a downshaft on the north, below the little bridge (on which is *caposaldo* 199) to the north of the chapel. The shaft measures 0.58 by 1.15 m. internally, and discharges into the *specus* of the Anio Vetus, the intrados of which was levelled at 215.27.⁵ In the quarry beyond this point the bottom of the Marcia's *specus* (III. 14) is visible. The sides are rock-cut, with an Augustan concrete vault. A few metres farther on the bottom is again seen. We then reach the Grotte Sconce (Fig. 31): under a downshaft of the Claudia⁶ the *specus* is only 0.67 m. in width, and roofed with two slabs of tufa; whereas just before this it is roofed with large rough voussoirs and walled

¹ The top had been laid on boards; the deposit was very foul. It has recently been concealed by piling earth upon it.

² PBSR. iii. 193; *Atti di Tivoli*, viii (1928), 32 ff. = *Via Tiburtina*, 180 ff. *Lanciani*, 46: 258 (cf. *Sched. Vat.* 37, ff. 4) follows Canina in attributing this *specus* to the Anio Vetus: and supposes that the reservoir under Villa Salerno, of which he gives a plan (*ibid.*, pl. i, fig. 8), which supplied the large villa on the slope to the west was fed by the same aqueduct. Nibby (*Analisi*, i. 47; cf. *Schede*, ii. 50, plan) had rightly attributed it to the Marcia. A plan of it will also be found in Belgrand (*op. cit.* p. 45, fig. x) and Parker (*Historical Photographs*, 535, and *Aqueducts*, pl. x). Parker's attributions of other reservoirs to the Marcia (*Aqueducts*, p. 118 *bis*) are erroneous.

³ Near its eastern extremity the concrete roof of the *specus* is at ground-level.

⁴ *Atti*, cit. 34 = *Via Tiburtina*, 282. Above the chapel, just after the valley has ended, is a portion of the *specus* 1.30 m. wide with a pointed roof of large blocks of stone and gravel mortar between them; see Parker, *Historical Photographs*, 1524.

⁵ *Livellazione*, p. 49. Whether the intrados of the Marcia levelled at 230.32 m. was on the north or the south side of the little valley, I do not know: and I have therefore omitted it from the tables. At iii. 14, the floor is at 228.54 m.

⁶ *Infra*, p. 278.

with large rough pieces of limestone concrete below, being as much as 1.45 m. wide. A shaft into the *specus* is seen, apparently rectangular, about 0.90 m. wide, and originally of *opus reticulatum*, but restored. Its intrados is at 230.70 m. where it passes below the downshaft of the Claudia. The channel occurs again just before the Voltata della Carrozze (*caposaldo* 198, near II. 18), having a pointed roof of large stone slabs. The upper wall and the bottom of the *specus* are formed of the natural rock; the lower wall is of large pieces of limestone.

West of Ponte Arcinelli¹ are scanty remains² in the small stream of rough travertine concrete of the Augustan period. The deposit is rather foul. Then the *specus* is seen on the south side of the valley which the bridge spans. There follows a small cistern of Augustan concrete faced with *opus reticulatum*, incorporating an original ashlar arch which led out of a stone-built *specus*. It lies on the edge of the path: an external ledge, corresponding with the bottom of the cistern, was levelled at 225.95 m.; so the tank no doubt received its supply from the Marcia. On the south edge of the road, under an olive tree, there is a branch leading to the Anio Vetus, the extrados of which was levelled at 223.92 m. The interior is 1.80 m. wide or more: the older ashlar is used in its concrete, but brick-facing is also to be seen in the interior. A little farther on, just beyond and above *caposaldo* 196, the pointed roof of the Marcia occurs, made of slabs of limestone and of a local red tufa. This *specus* is also seen in an area between two field-walls at right-angles to the road; the tufa slabs are each about 0.60 m. long and 0.30 thick, and the width is approximately 0.70 m.

The aqueduct is not then seen again until after the Franz stone³ (*caposaldo* 195) and the Grotta Papale; then, in the second valley from Tivoli, comes an isolated piece of late concrete, probably levelled as 'the bottom of the upper *specus* III' (226.98 m.), though it must really have belonged to a higher part of the channel. Almost immediately, in the bushes to the right of the valley and on the left of the road below I. 28, the gabled *specus* appears, with tufa roofing-slabs 0.25 m. thick and 0.70 to 1.35 m. long; the side walls are of rough red-brown tufa blocks 0.25 and 0.35 m. high, while the roof is covered in protective concrete. The next view of the *specus* is below the road and below II. 16. When the

¹ Just before reaching the Arcinelli there is a villa on the right with a fine platform faced with polygonal stones, and under the road there is a branch to its *piscina*, which is small, two-chambered, and well preserved. The bottom of this *piscina* lies at 220.38 m. This has been called the villa of Fuscus by older writers on Tivoli. Parker, *Aqueducts*, pl. ix, fig. 2 = Herschel, p. 156, shows a part of the side of the platform of the villa as though it were a *castellum* of the Marcia.

² Noted by Nibby, *Analisi*, i. 28.

³ *Atti di Tivoli*, cit. 38 = *Via Tiburtina*, 186.

PLATE IV



AQUA MARCIA: PONTE S. PIETRO

levelling was made, only the tufa roofing-slabs were visible, but a long piece of the channel has recently been cleared, in construction exactly like the last piece: it is over 0.60 m. wide and the roofing-slabs measure 0.25 by 0.70 m. About 50 m. of it was visible in the road on the farther side of *caposaldo* 193, running quite straight; there was first a late concrete *puteus*, followed by 5 m. of *cappellaccio* roofing blocks, and then by a cut in the living rock, itself *cappellaccio* (III. 13). All has now been covered up and nothing more is to be seen for a considerable distance. Nibby,¹ indeed, writes as follows: 'al terzo miglio (from Tivoli) diradasi l'oliveto e tosto riconosciesti l'acquedotto Adrianeo traversarsi la via.' This point must be only a quarter of a mile before the circular *piscina*, near *caposaldo* 148, and the reference is thus to this *specus*; but it is doubtful what he means by assigning it to Hadrian, for he can hardly have believed that it belonged to such a period.

The Aqua Marcia, like the Anio Vetus, ran deep underground in the neighbourhood of Gericomio; and the writer has not found any *putei* belonging to it in the stretch between III. 13 and III. 12, a distance of something like 3 km. Petroncelli, in the map annexed to his letter of 7 September 1739, marks a *puteus*, not to be confused with that of the Anio Vetus, which he also notes, on the hill north of the deep Fosso dell'Acqua Raminga, which divides the Casale and Torre of that name. There is to-day a considerable portion of its channel to be seen on the north side of the stream, descending rapidly, as Petroncelli notes in the map attached to the letter quoted. The construction is very bad, with walls of rough unfaced concrete attributable to either Augustus or Titus. The *specus* is 1.15 m. wide and is round-topped, except at the shaft, where it is gabled. It is first seen in the cellar of Casale Acqua Raminga; in the first *puteus* (1.15 by 1.18 m.) after the cellar it is at 223.56 above sea-level (III. 12). 25.40 m. from this (at *a*) the intrados is at 219.58; and at a point considerably farther down the impost is at 200.83; while at the stream (*b*) the bottom is at 193.68 (III. 11). The distance between points *a* and *b* is 204 m. and, allowing 3 m. for the height of the *specus*, the fall is thus 21.90 m. in 204 m., or 1 in 9.29, or 107.35 per 1,000.² The descending *specus* runs 10° E. of S.; but at *b*, where there is some heavy hard crystalline deposit, there is a turn to 40° E. of S. to cross the stream. There is a deposit *in situ* in the *specus* on the farther bank. If there was a bridge here at all, it was a very small one, of which no trace now remains.

From this point the Marcia tunnels under the hill of Torre

¹ *Schede*, ii. 52.

² Not 121 per 1,000, as stated in *Livellazione*, 76, where the fact that *a* is the intrados and *b* the bottom has not been taken into account.

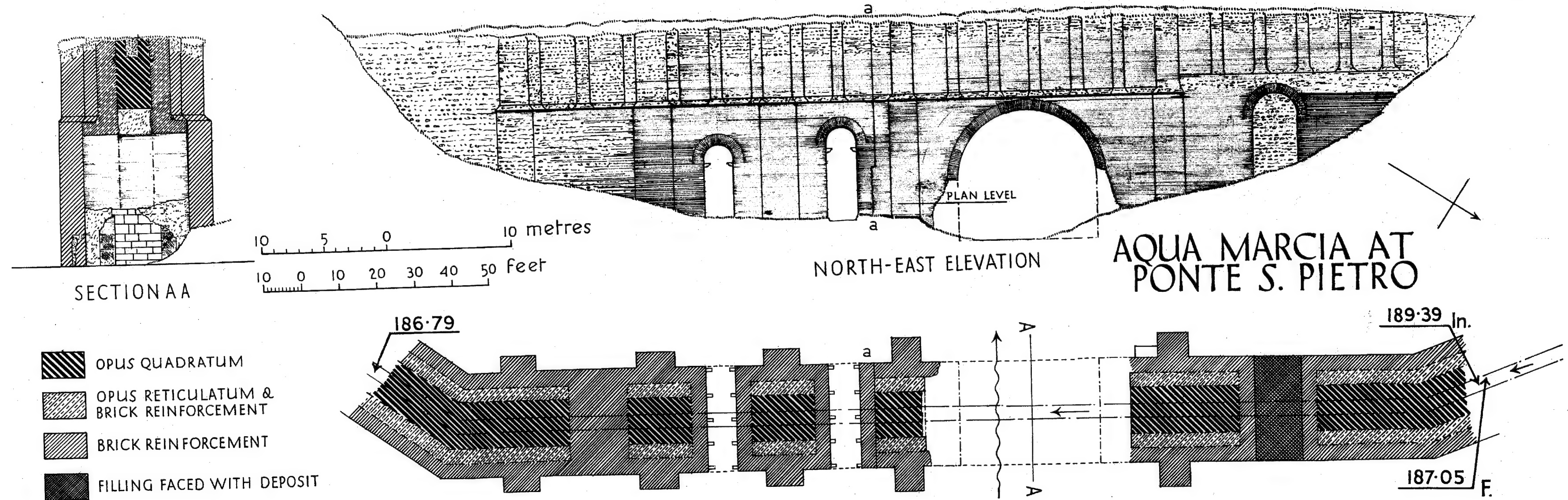
dell'Acqua Raminga, until it reaches a little valley leading into the larger Valle della Mola di S. Gregorio. It follows the north-east bank of this upstream, and above the modern path, about 200 m. north-west of the Ponte S. Pietro, are two circular *putei* in *opus reticulatum*. The Ponte S. Pietro (Pl. IV; Fig. 10) was originally built in ashlar of local porous limestone, with one large central arch, no less than 15.50 m. in span, over the small stream. The piers were only 3.84 m. thick at the base, diminishing in width to 2.77 m., and the effect must have been very fine. There was presumably a smaller arch on the north-west bank and three on the south-east; but the structure is there entirely enclosed by later concrete. The first reinforcement was of concrete, faced with *opus reticulatum* quoined mostly in brick, but in tufa under the central arch: and the first reconstruction of the *specus* wall is of this material also, as seen at the north-west end of the bridge.¹ This work probably extended under the whole of the central arch, though its presence is only attested by the unfaced later reinforcement once built against it, and by a little preserved on each side of the stonework. This reinforcement may be attributed, on Dr. Van Deman's scheme, either to Titus or to Hadrian. Much later, probably under Severus,² the whole structure was masked with brick-faced concrete and projecting buttresses, while smaller brick arches, with stone corbels to take scaffolding for repairs, took the place of the larger ones. The arch over the stream still indeed retained a fairly large span of 11.20 m. with interesting ladder ribs, but those of the lateral openings were quite narrow, the last on the south-east bank being completely blocked up. The diminution in the height of these openings having made the top of the bridge disproportionately high, the long wall was divided by pilasters, the bases of which correspond with the point where the buttresses become thicker (section AA). The structure may be compared with the bridge of the Aqua Claudia at the Fosso Maiuro. At a still later period, probably under Diocletian, the whole south-east end of the bridge was reconstructed, as appears to be indicated by the straight joint *a* and by the change of style in the facing.³ Finally, the opening on the north-west bank was filled up with concrete faced with pieces of aqueduct-deposit, at a very late period.

¹ It should be noted that the section AA was taken at the centre, and that the character of the original *specus* is, even there, hypothetical. The existing *specus* is 1.07 m. in width, with concrete walls faced inside with small rough stones, belonging to a late restoration (with a cement lining 0.06 m. thick), and outside with brick and *opus reticulatum*. These walls are 0.85 m. thick. Next comes a strengthening wall on each side faced with brickwork, 0.30 m. thick, and then a concrete wall 0.80 m. or more thick, perhaps belonging to the great reconstruction by Diocletian.

² See *Proc. Brit. Ass.*, 1925, 149; Dr. Van Deman concurs.

³ It is also possible that the change in construction is due to the poorer work of a less expert gang.

FIG.10



On leaving the bridge, the aqueduct turns sharply, and is soon to be seen running for some 20 m. 10° S. of W. along the side of the valley, under some large masses of rock. The construction is of rough late concrete, and no facing is visible, the *specus* being full of deposit. It then disappears into the hill-side, passing under the ridge which carries the Via di Poli, and emerges in a still deeper valley known as the Valle dei Morti in Valle dell'Acqua Rossa, to which a path descends at the 29th kilometre-stone of Via di Poli. At least 200 m. before Ponte Lupo is reached, there begin to appear, well below the level of the *specus*, massive substructures in concrete. The first stretch, much hidden by bushes, is a great wall, faced with *opus reticulatum*, supported by six or more buttresses and quoined in small rectangular blocks of tufa. The absence of brick suggests to Dr. Van Deman that the whole may be of Augustan date, as also applies to the second group of supporting walls, rather lower down. Only the third group, with at least five buttresses, exhibits an admixture of brick, and may, therefore, belong to the Flavian age: to which also belong the buttresses (see Figs. 11 and 12) running right down the bank to the stream, where the path descending from Via di Poli crosses the *specus*. The *specus*¹ has a round vault 0.40 m. high (III. 10), and the lower *specus* wall, 0.75 m. thick, is of concrete faced with *opus reticulatum*. Between this point and the actual bridge there is a slight change of direction and the *specus*-wall is supported by nine buttresses, faced with rectangular blocks of tufa, all dated to the period of Agrippa:² they have been enclosed in very late brick-work, perhaps of the fifth century, and certainly the latest work to be seen on the site. The *specus* now turns at right angles, with a shaft at the turn, and reaches the bridge of Ponte Lupo.

This bridge is the most famous and impressive of all the aqueduct-bridges (Pls. III b; V a, b; Figs. 11, 12). It has been thought³ to have carried the Anio Vetus, the Marcia, the Claudia, and the Anio Novus. But one of the most valuable results of the levelling has been to establish that it can have carried only the Marcia. Further, a glance at the map (Map 4) shows that to bring Aquae Claudia and Anio Novus by this devious route would add considerably to their length without corresponding advantage. Previous representations of the Ponte Lupo are not of great service:

¹ *Livellazione*, p. 40, fig. 29 bis.

² There is a similar, but smaller, buttress close to the stream at d, considerably below the level of the plan.

³ *Cassio*, i. 155; Rondelet, pl. ix, fig. 1; Canina, v. 151; vi. 147; *Lanciani*, 79: 291. Revillas (in his notes at the British School) speaks of 'at least two' aqueducts, and of three orders of substructure on the north bank, the two lower of which join the lower aqueduct, which had a *puteus* near the centre of the bridge (I do not know to what this refers). Canina absurdly takes these substructures as the remains of the dwellings of the guardians of the aqueducts!

Rondelet's view can only be described as inadequate, and Canina's plan, sections, and elevations are not very much better.¹

It is not easy to be sure² whether the earliest work visible really belongs to 144 B.C. This is the stonework of the lower central section, consisting of two massive arches, each 6.80 m. in span and 17.80 m. above the water; the side piers, bedded on the rock without a concrete foundation, are 5.80 m. wide at the base, exclusive of buttresses, and 4.30 m. wide in the upper part. The central pier, 6.80 m. wide and 3.30 m. long, finishes off in a cut-water down-stream. As in Ponte S. Antonio, projecting courses have been left at two points, for scaffolding when repairs were required. The stone used is red-brown tufa, quarried on the left bank of the valley, level with the top of the bridge. The heights of the courses are unequal, but the blocks are regular, and laid as headers and stretchers. They are decidedly larger than most Republican work; but too little is known about the dating of ashlar to dogmatize; and, on general grounds, it seems best to attribute this part of the structure to Marcus. The position of the original *specus* is not quite certain. If it lay, as on a normal pier, at the level of the string-course above the arches, its height above sea-level would be 176.25 m.,³ which would give a very rapid fall from Ponte S. Pietro;⁴ while at the next two points where levels are known (III. 9 and III. 8), the intrados is respectively at 183.39 and 181.61 m. In other words, to place the *specus* here implies that Augustus altered the levels of this whole sector of the Marcia, a conclusion for which we have no warrant. This would suggest that there was a high attic below the *specus*, as on the Claudia at Porta Maggiore.

The first reconstruction may be ascribed to the administration of Agrippa. It begins, as already noted, with the *specus* on the north-east bank of the stream,⁵ just before the aqueduct turns at right angles. At the turn the square shaft communicating with the *specus*⁶ is faced with good *opus reticulatum*. On the bridge, between the projecting string-courses (about 0.15 m. high) which mark the top and bottom, the *specus* measures about 2.00 m. high and 1.20

¹ He postulated an original bridge for the Anio Vetus, measuring 81.10 m. in length, 11.20 m. in height, 2.75 m. in thickness: when the Marcia was added, on the east side, these measurements were increased to 88.90, 16.60, and 12.00 m.; while by the addition of the Claudia and Anio Novus, which produced the structure that we now see, they rose to 155.00, 31.60, and 14.10 m. respectively. The last three figures should really be 111.00, 27.60, and 18.60 m.

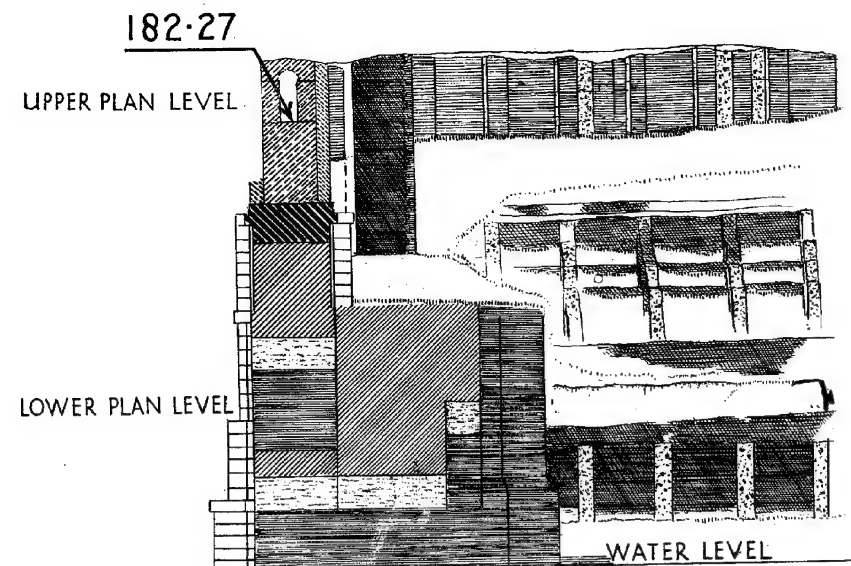
² A reasoned discussion of the date of this and the other types of construction to be found in the bridge is given by Dr. Van Deman, whose dating has here been attached to the periods distinguished.

³ *Livellazione*, p. 41, fig. 29.

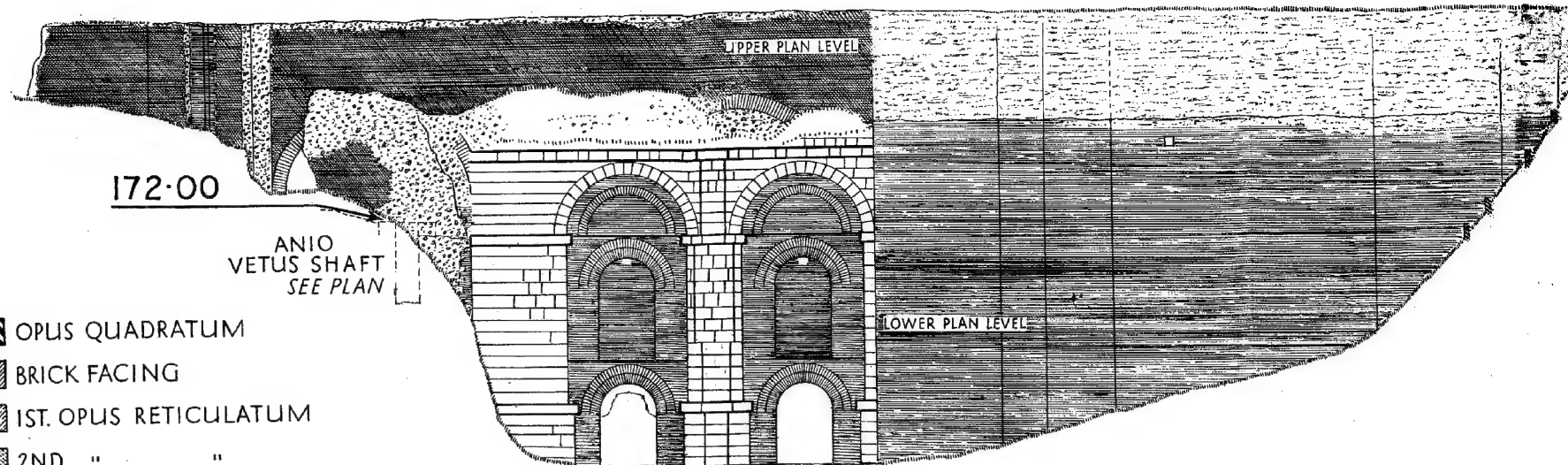
⁴ As it is, the fall is 4.52 m. in about 1,500 m., whereas this would give us no less than 10.54 m.

⁵ *supra*, p. 117.





⁶ Lying below the shaft I noticed a slab of cement, 0.80 by 0.90 m. and 0.30 m. thick, which seems, however, a little too small to have served as its cover.

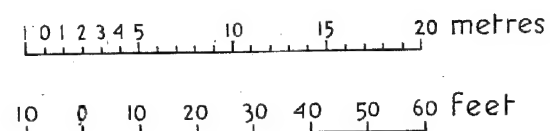


SECTION AA

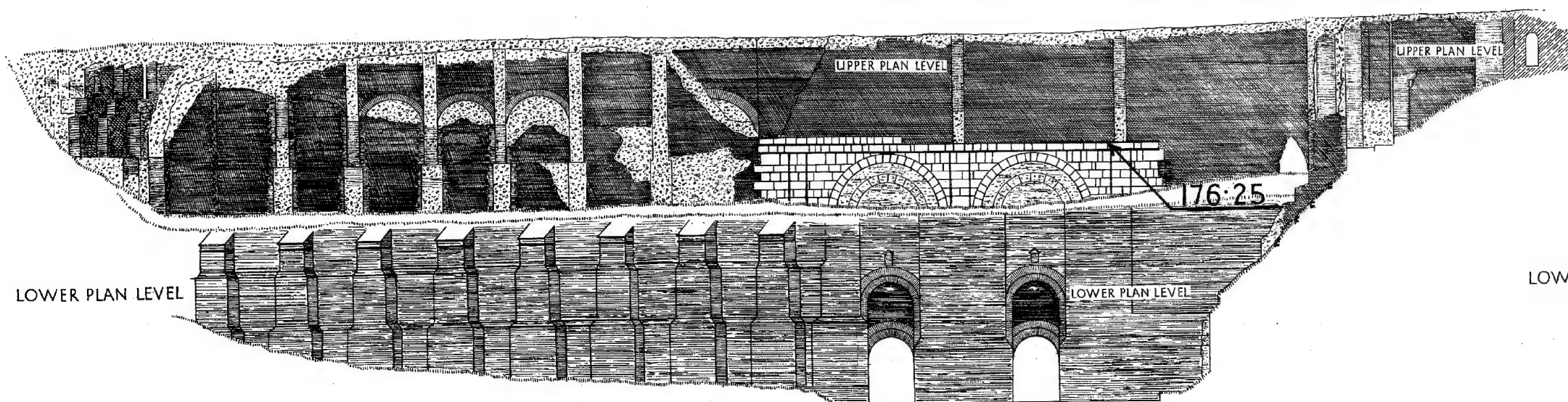


WEST ELEVATION

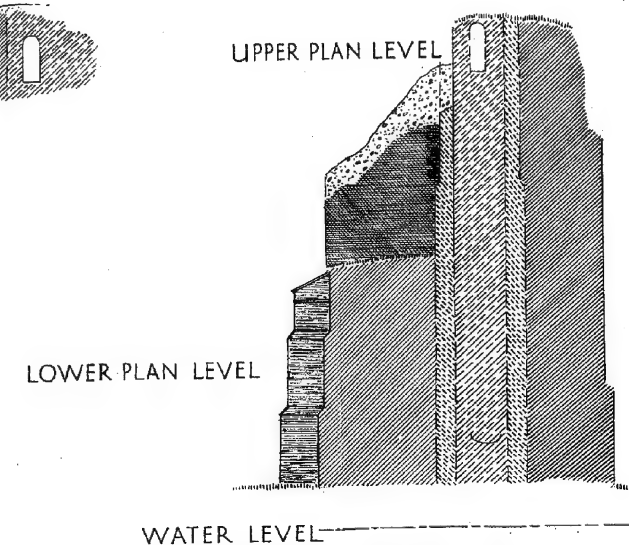
-  OPUS QUADRATUM
-  BRICK FACING
-  1ST. OPUS RETICULATUM
-  2ND. " "



AQUA MARCIA AT PONTE LUPO

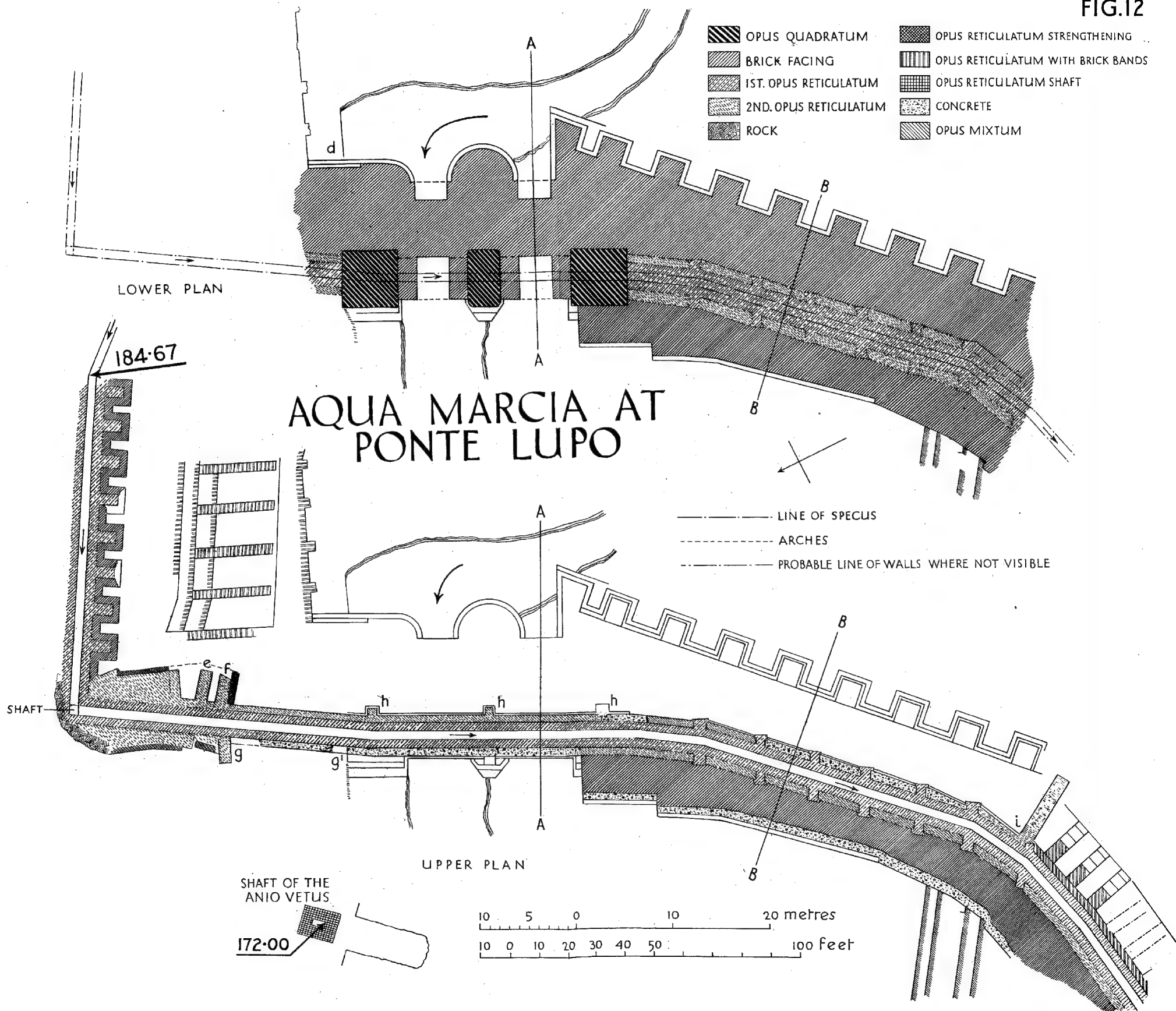


EAST ELEVATION



SECTION B B

FIG.12



wide,¹ while the vault adds another 0.40 m. to the height. It is supported on large arches, the first 11.50 m. in span, with a double ring of tufa voussoirs, each 0.45 long, finely cut and laid with very thin mortar joints. The south end of this first arch has been fitted into a bed cut into the ashlar pier, as can be seen on the west side. The width of this superstructure was considerably less than that of the masonry bridge, being only 2.80 m.; but a massive buttress was placed within the right-angled turn at the beginning of the bridge, while smaller buttresses were set on each side of the *specus* all the way along on the south end after the ashlar work ends.² Whether the numerous slight changes of direction are due to this construction or are original is difficult to say. The whole exterior of this structure appears to have been covered with cement. After this, certain modifications were made, and are roughly of the same period, probably a late-Augustan restoration. A mass of concrete, faced with *opus reticulatum*, was added at the north end on the north-west side to counterbalance that on the buttress at the turn; at the other side of the bridge a wall was built up against the side of the *specus*, so as to rest on the original ashlar, with buttresses (*h*, *h*) above the original buttresses; panels were also inserted between at least the first three of the first-period buttresses,³ and presumably continued all along on both sides,⁴ though this is not very certain (Pl. III *b*).

The panels just described did not hold in position for very long. It was found necessary, in the Flavian period, to put new panels in all but the first two intervals, carrying them now on arches of two-foot tiles, bedded into the early buttresses of the Agrippan reconstruction, and facing them with concrete faced in reticulate. Of the same period are the reticulate work with brick bands at the north approach to the bridge, already described, and the three buttresses and the reinforcing wall on the south side at the west bank.⁵

The next repairs are Hadrian's. *Opus reticulatum* with tufa

¹ *Livellazione*, p. 40, figs. 29, 29 *bis*. The levels of the intrados (III. 10) and of the bottom were of necessity taken at two different points, and the difference between them is 2.40 m.; while the extrados at the extreme south end was levelled at 185.07 m. It was unfortunately impossible to ascertain the fall on the bridge.

² Their existence has been assumed on the west side also, though here they are entirely concealed by the great brick-faced concrete wall which masks the whole structure. We do not even know what they stood upon, but they probably correspond to the buttresses of the original structure, which may have been reconstructed to some extent.

³ It is especially interesting to see how the *opus reticulatum* is keyed into the ashlar. At *a*, *opus signinum*, 0.04 m. thick, has been applied to the exterior of the structure—for what purpose I do not know.

⁴ To this period belongs a low footing between *g* and *g'*, below the level of the plan, with a passage way 0.75 m. wide through at *g*, under the first arch of the previous period.

⁵ There is a *reticulatum* wall in the path here (below plan level) in which the cubes are chipped, not sawn, which also belongs to the period of Titus.

quoins is used once more,¹ and extends to the following features: the filling, under the Flavian panels supported on arches, on the south-east side; a large new buttress (*i*) between the last of these arches and the three Flavian buttresses on the same side²; the successive walls on the north-east bank on each side of the bridge-head, which unite as one solid mass the buttresses of the first and second Augustan periods, the tops of buttresses *e* and *f* being removed to give these additions a better bond: and the original weep-holes, which were filled up, two *reticulatum* cubes being replaced by one rectangular block.

The next phase of reconstruction is that of Severus. The two main stone arches were underpinned with concrete, narrowing the opening to 3.60 m. wide and 5 m. high, with two arches and a lunette, whose vaults are turned in ladder-ribs. The vertical joints in the piers are builders' joints; and, while in the left-hand arch even the bonding-courses do not go through, in the right-hand arch the construction is continuous. The vaulting was covered with tiles 0.30 m. square,³ held in place by small pieces of brick set on edge; one of these tiles, in the north-east arch, bears a stamp⁴ of the early second century, showing that older material was used. On the north-west side, the upper arches are deeply recessed, like that on the east side of the south end of Ponte S. Antonio;⁵ on the south-east, they are only slightly recessed, and each is surmounted by a small panel, as if for identification by number or name.

To the same period belongs the vast reinforcement on the upstream side, by which the whole structure was widened by some 8 m., up to the level of the masonry impost-moulds, concealing all earlier work. A massive curved buttress was placed on the central pier, with corresponding abutment-walls on the right and left banks of the stream. Beyond the south abutment, which is of a peculiar shape owing to its vicinity to the stream, are eight great buttresses, each 3.50 m. thick, projecting about 3 m., and 2.50 m. apart at the base; the main wall and the buttresses have two offsets, each of 0.45 m., while the top of the buttresses is battered, to allow rainwater to run off.

To a later period still, probably the restoration of Diocletian, belongs a huge brick-faced wall on the down-stream side, which

¹ It can be distinguished from Augustan work by greater regularity in the laying of the *caementa*, and by the cubes being sawn and not chipped, as Dr. Van Deman points out.

² The end of this great buttress fell in a recent earthquake.

³ At Ostia, in the Casa di Diana, and at Rome in the Sette Sale (the latter, unless restored, being the earliest instance we have) we notice that over these small tiles there was a layer of *bipedales*, and then came the plaster of the ceiling proper: but this was probably not the case here.

⁴ *CIL.* xv. 2336, *L. Licini L. f. Successiani*.

⁵ Above comes a cornice, with a relieving arch in the lunette.

masks the whole south-west end of the aqueduct, from the ashlar pier on the right bank onwards.¹ The uppermost part of the facing has fallen away; and just below the present top there is a small square hole, of uncertain purpose. Corresponding with this wall are four supporting walls of concrete running along the south-west bank of the stream at different levels; but these may be even later in date, for the writer once saw an *opus mixtum* facing on one of them, not visible on his last visit. Finally, high up on the steep slope, farther along the same bank (outside the plan) there is a massive wall of rough, badly-laid concrete, the facing of which has now completely disappeared; it must have supported the *specus*, and part of it is now a fallen mass not far above the stream, opposite the shaft of the Anio Vetus. The wall supporting the buttresses on the right bank may belong to the same period.

(e) *Ponte Lupo to Capannelle. Maps 2, 3, 4.*

On leaving Ponte Lupo, there is a *puteus* on the hill-side to the south-west, clearly circular, though much ruined by cultivation. Deposit can also be traced in the same direction; and about 100 m. south-east of the point where a small tributary of the Fosso dell'Acqua Rossa turns at right angles, there is a small bridge² of late brickwork, seemingly contemporary with the latest work at Ponte Lupo. It carried the aqueduct over the stream at a point where there is a considerable drop in level, and it had two or three external buttresses. The *specus* (III. 9) runs south-west, and at least 2.08 m. in height,³ with a vault in concrete laid on planks. The walls of the bridge are 0.93 m. and 0.73 m. thick, giving a width over all of 2.76 m., with a span of 1.50 m.; and there is a buttress on the south-west side, projecting 1.47 m. The aqueduct turns sharply westwards on crossing the valley, but must very soon turn to the south once more.

The Aqua Marcia passed under the Fosso dell'Obago, in which none of the aqueducts comes to the surface, and then reached the Colle Grotta dell'Acqua, which takes its name from a small brick-faced cistern. There is much deposit from a *puteus* in a vineyard here, and to the south-west an actual *puteus* was found, now modernized; still farther south-west, on the part of the hill that is called Collacchio, the presence of deposit indicates the existence of a third,⁴ while a fourth has been modernized. The aqueduct

¹ The fact that some of the blocks in this pier had shifted before the concrete wall was built, and have not moved since, shows the necessity for its construction. Its steps and footings are shown in the plans; cf. also pl. V a.

² Some stone blocks, perhaps belonging to the original bridge, lie in the stream some 15 m. lower down.

³ It was impossible to reach the bottom owing to the influx of water. Intrados, 183.39.

⁴ On the map the first two are of necessity shown as one.

then reached the valley of Rio Secco, known also as Valle Serra, some 600 m. above the Ponte Taulella, and about a mile north-west of the cemetery of Gallicano. At this point, the valley is an extremely difficult obstacle, for the right bank has collapsed in many places. The main floor is 30 m. deep and there is another 25 m. to the bottom of the narrow gorge in which the stream flows, as at Ponte Taulella. The engineers of the Claudia and Anio Novus wisely tunnelled below it; the Marcia crossed it at about the first point where anything like hard tufa rock was to be found, but even this has given way. Just before the bridge is reached, the round-headed *specus* may be seen going 20° E. of S. (III. 8); it is 2.24 m. deep to the hard deposit on the floor, which may be estimated as about 0.10 or 0.15 m. farther down.¹ Just above it are the remains of a *puteus* in *opus reticulatum*, and this, like what is left of the bridge, appears to belong to the Augustan period. At this point the *specus* turned south, but has fallen away; and on the bridge it must have turned west a little. The bridge has almost entirely collapsed. Large masses of concrete lie in the stream; on the north-east bank there is practically nothing at the *specus* level, and in the stream a little concrete *in situ*;² but on the south-west bank, towards the top of a cliff some 30 feet high, only reached with great difficulty from above, a mass of concrete, about 0.66 m. thick, rests upon four blocks of ashlar; it carries the bottom of the *specus*, of which the south-east wall, with heavy deposit, still remains.³

To the south-east, on Colle Caipoli, there is a *puteus* in *opus reticulatum* (north-west of point 232 on the map), and below it, in the upper part of the valley of Fosso Caipoli, there must have been three or four *putei*,⁴ for the deposit can be traced for some 400 m. north-west of the bridge; one of them, circular and faced with *opus reticulatum*, is still preserved.

The stream itself is crossed by a bridge (Fig. 13), at about 150 metres from the last *puteus*. This bridge, at a right-angled turn, was originally a single arch of ashlar, rising some 13 m. above the stream; but only the spring is preserved on the north-east bank⁵ with some remains of a buttress low down on the south-east side, and a little on the south-west bank on the same side, just below *specus* level. It was afterwards enclosed in a reinforcement of fourth-century brickwork, in which two superimposed

¹ For 0.50 m. of deposit had already been removed when this point was reached in our investigations. Intrados, 181.61.

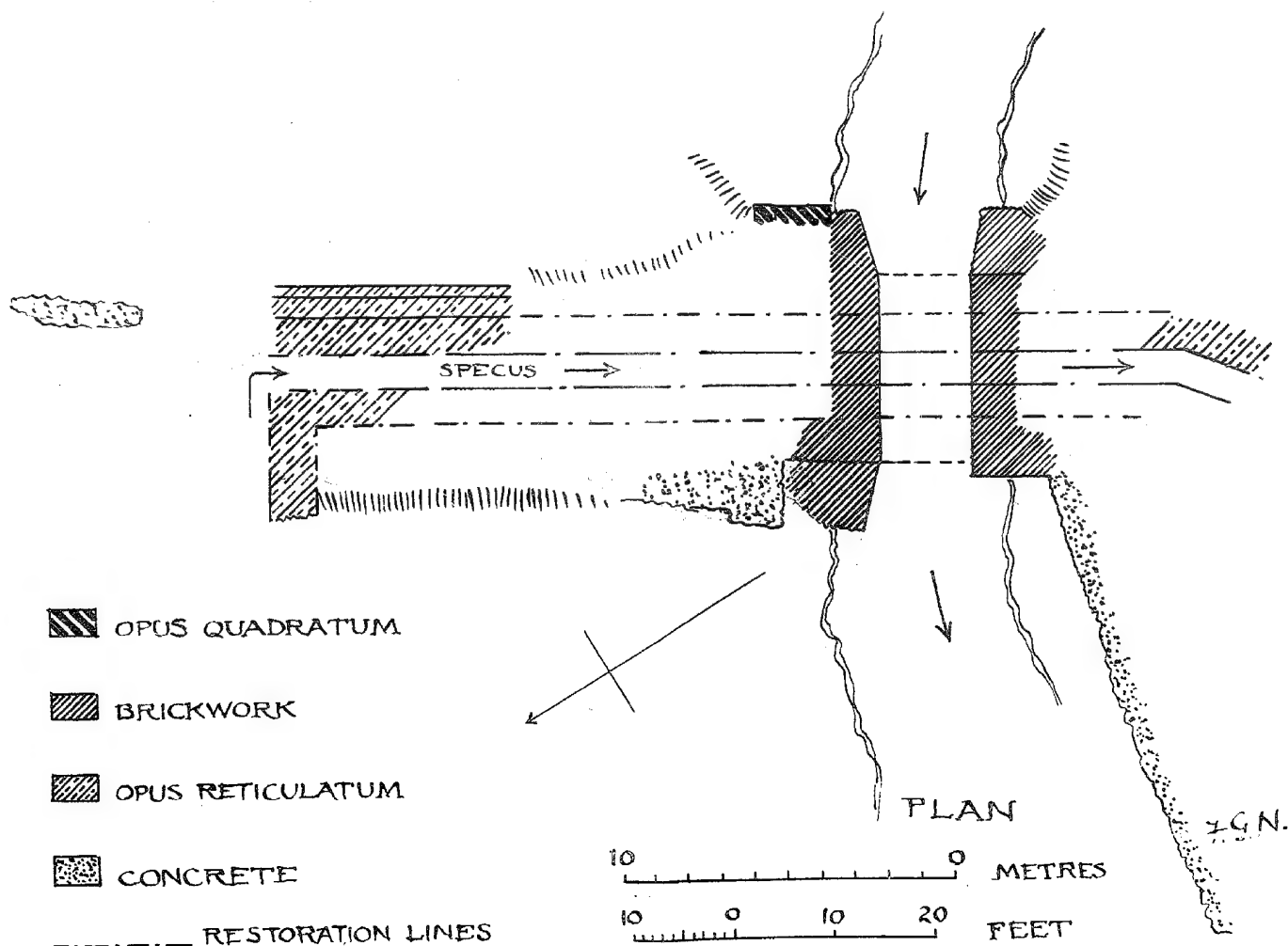
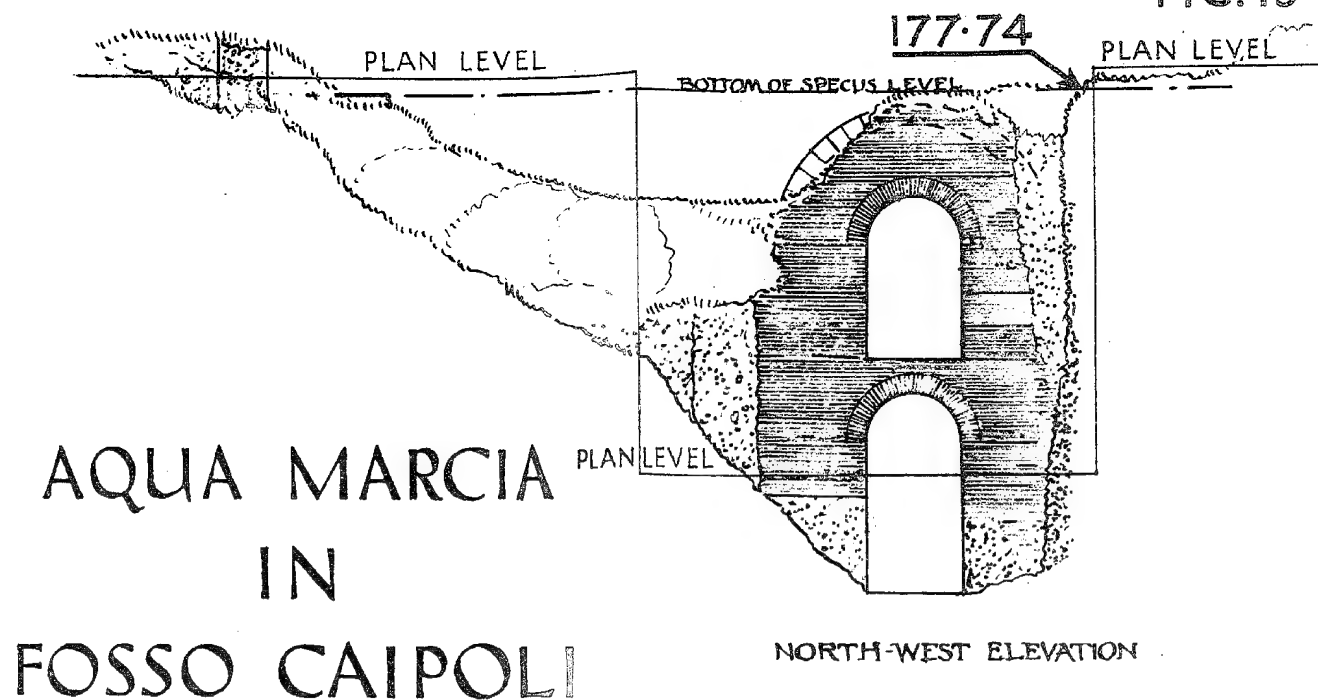
² The bad weather of 1915 caused the north-east bank to collapse still further.

³ Lanciani, *Sched. Vat.* 37, f. 42. As a level was taken on the north-east bank, we did not think it necessary to attempt to take one here.

⁴ Two are indicated in the map.

⁵ A good deal more is visible from the end than one would suspect from the plan. See the point where the brick filling has fallen, revealing part of the arch.

FIG. 13



arched openings were left. The abutments and walls of the *specus* on each side of the bridge are faced with excellent *opus reticulatum* with tufa quoins, of Dr. Van Deman's Hadrianic type, though on the south-east side, at the north-east end, are three distinct faces, belonging to the same period. The hard crystalline deposit is about a foot thick on each side of the *specus*, levelled at 177.74 m. (III. 7). As at Ponte Lupo and elsewhere, heavy masses of rough concrete support it on the south-west bank after the turn from the level of the stream upwards.

The aqueduct then passed under Colle Collafri, and crossed the Fosso Collafri (called Fosso della Mola below the Mola di Gallicano) by a small bridge named Ponte della Bulica (Pl. VI a). This is a single stone arch of very fine Augustan style; the span is 5.85 m., the height of the arch is 5.50 m., and the length and width of the bridge are 10.60 m. and 3.33 m. (III. 6, 168.24 m.). The earlier *specus* has entirely disappeared, and the bridge was reconstructed after it had collapsed,¹ concrete, now vanished, being added on the south-east side. The new *specus* ran just to one side of the former channel. It is lined with brickwork, and coated with deposit 0.22 m. thick, on each side. Some concrete buttresses, faced with rough stone and aqueduct deposit, have also been added on both sides; those on the south-east, 3.65 m. wide, carrying one side of the new *specus*. The deposit is, once again, characteristic of the Marcia.

After Ponte della Bulica, the Marcia must have run SSW. passing under Colle Selva, Valle Inversa and the Via Praenestina. The writer has found no indications of its course until the north end of Colle Farina is reached. Here, about 100 m. south of Via Praenestina, there is some deposit which may belong to it, and 100 m. or more to the south-west, there was a tufa *cippus*² in position, facing N. by W., and numbered 509. The inscription, fairly well preserved, runs: M(ar) | (Im)P. CAESA(r) (di)VI F. AVGVSTVS | EX.S.C | DIX. | P. CCXL.

In 1927 there was much loose deposit in the new vineyards near Via Praenestina, no doubt from a *puteus* which I had previously noted, and an uninscribed tufa *cippus*³ lying loose. Two hundred and fifty metres west of *cippus* 509, and 20 m. west of the ancient road on Colle Farina, are the traces of a *puteus*, faced with *opus reticulatum* (this is marked in Map 4, the *cippus* being omitted);

¹ The explanation given in *Builder*, 174—that the arch at one time supported a roadway—is to be rejected.

² I had not seen this *cippus* in 1908, when *Builder*, 174, was written. The letters of the first line were 0.65 m. high: in the rest they varied from 0.05 to 0.04 m. The *cippus* itself was 0.49 m. wide, and measured 0.685 m. from the top to the bottom of the portion of it which was smoothed to take the inscription. On revisiting the spot in April 1927, this *cippus* had disappeared.

³ It was 0.95 m. high over all, 0.60 m. wide, and 0.28 m. thick.

and 100 m. farther on, in Fosso dell'Acqua Nera, some 300 m. down-stream of the Ponti Diruti, a substructure of Aqua Marcia is traceable for about 200 m. on each side of the stream; the top of the *specus*, which was pointed and about a metre wide, is a little above ground-level on the west, while the bottom is visible on the east bank of the stream, with some cement below it, on which the level (III. 5, 164.26 m.) was taken. Ashlar facing may be seen on the north-east bank, where there is also some post-classical work, possibly a mill-dam. The direction of the channel is south-west by west, and it then turns to 30° S. of W. A little indeterminate concrete was seen farther down the stream.

There is a second *puteus* WSW. of the crossing (see Map 4) and a third to the west before the west branch of Fosso dell'Acqua Nera is reached, with a tufa *cippus* standing in the field by it; the top portion is badly weathered, and the hole for the log, which held it in position below ground, is clearly visible.

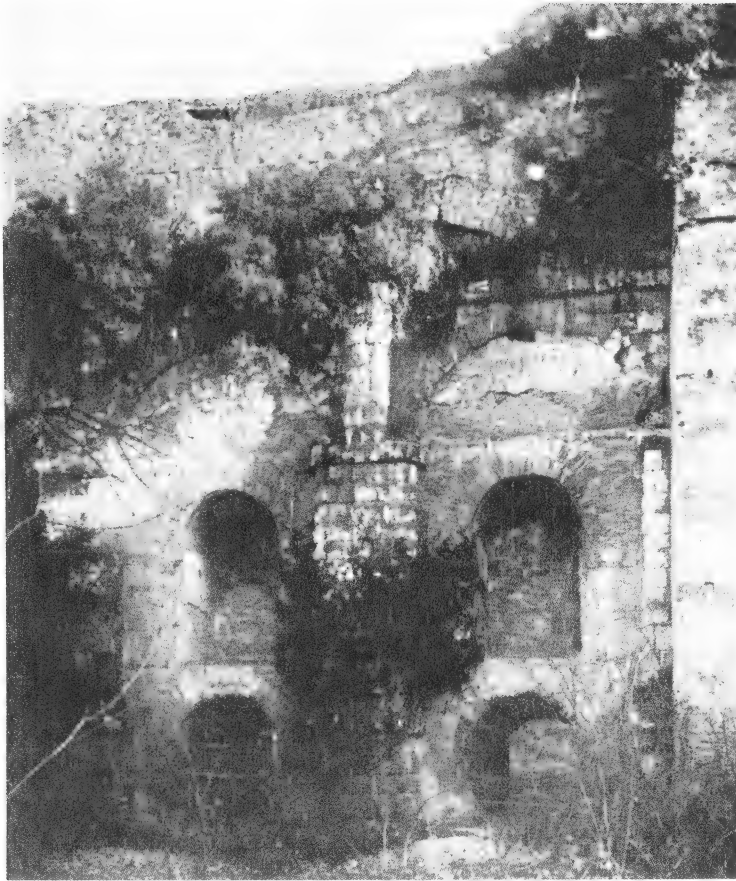
The aqueduct must now have turned to the north-west, for in this direction, in the west branch of Fosso dell'Acqua Nera, there are the remains of a small bridge, in concrete faced with tufa *opus reticulatum*, which must be attributed to it (III. 4, 163.51 m.). The *specus* is choked with deposit, and there is a half right-angle turn on the west bank directly after the crossing. There is later strengthening in concrete both up and down stream.¹

Some deposit is seen on the hill to the west, and also beyond the next small stream to the south-west of the Fontanile del Linaro. Here, too, there is a tufa *cippus* (attributed in the map to the Claudia) 1.25 m. high, 0.44 m. wide, and 0.30 m. thick; and there is another farther west, 0.52 m. in width. The next stream, the east branch of Fosso di Biserano (Fosso Scuro), has a narrow but deep bed, and is crossed by two ashlar bridges, 6 m. apart, and about 60 m. above the pier attributed to the bridge of the Anio Vetus. Though farther up-stream, this bridge is attributable to the Aqua Marcia because it is a good deal the lower in level. It is a single-arched bridge with a span of 3.50 m.: the arch is curiously flattened, measuring only 1.20 m. from spring to crown, in order to enable it to cross the stream at a low level, for the total height from the water-level to the crown of the arch is only 3 m. A level of 161.32 m. was taken on the bridge, but on the top of the string-course,² 1 m. below the path across the bridge (III. 3).

¹ Some 200 m. to the south of this bridge, a rock-cut channel is to be seen in the low cliff on the west side of the valley. It has a pointed roof and is 0.60 m. wide; the depth is uncertain, for it is filled up for the whole of the lower portion (*Livellazione*, fig. 22). The level on the intrados is 169.45 (*caposaldo* 92, where it is rightly called *incognito*). It does not appear to have any relation with anything on the east bank, nor can it have any connexion with either the Marcia (at 163.51) or the Anio Vetus (at 155.99). It is equally impossible to connect it with the Claudia and Anio Novus.

² Not on the keystone, as is stated in *Livellazione*.

PLATE V



a. AQUA MARCIA: PONTE LUPO, MAIN ARCHES,
WEST SIDE



b. AQUA MARCIA: PONTE LUPO, GENERAL VIEW FROM WEST

The bridge is only 2.90 m. wide, and there is no trace of the *specus*, though the string-course of flat blocks just above the arch may represent the bottom of the stone channel. The blocks in the course below the arch measure 0.62 m. in height and are heavily rusticated, with chisel-drafted margins; the rustication projects 0.11 m., and one stone is 2.60 m. long. No concrete is visible, but the dimensions of the stonework suggest a reconstruction rather than the original work of 144 B.C. There are quarries close by from which the tufa was taken.

There are no traces of the aqueduct in the shallow west branch of the Fosso di Biserano, though there is deposit in the fields to the west of it; but in Fosso della Pallavicina, on the north edge of the Laghetto di Monno or della Pallavicina (a deep horseshoe depression, probably a quarry for *selce*, on the east side of the valley) the Marcia reappears. There is some concrete on the east bank of the Fosso and also remains of the single-arched bridge across the stream, 8 m. south of that of the Aqua Claudia, though the collapse of the east bank has led to the disappearance of most of the eastern bridgehead, leaving only a little concrete fairly far back on the bank. There are more considerable remains of the western bridgehead, consisting of foundations in *selce* concrete, with a little Severan brickwork, like that of the Claudia, high up on the north side. The facing is not preserved lower down, but the width of the foundations must have been about 4.30 m.

From this point the Aqua Marcia must keep underground for a considerable distance, passing under Aqua Claudia not very far from the turn of the branch road to Pallavicina (II. 8); it must then have turned to run SSW. On the east side of the ravine of Fosso Cavallino are three heaps of deposit, which may mark *putei*, in a line running south-west. Then comes a portion of *specus*, in rough concrete with a round roof, now at about ground-level, and a *puteus* about 4 feet in internal diameter, faced with *opus reticulatum*; the direction of the *specus* is 40° W. of S. and the level rather less than 160 m.¹ On the west bank of the Fosso the top of the *specus*, in concrete, is seen between the north end of the quarry spoil-heap and the point where the field-wall crosses the stream about 30 m. away. North-north-west of Casale delle Cave the field-wall is full of aqueduct-deposit.

The Marcia ran underground from this point, and there is now no certain trace of it, excepting some heaps of deposit north-east of Casale della Pigna, before the upper end of the east branch of Valle Pignola. To south of the Fontanile di Valpignola,² west of Casale della Pigna and north-east of the small bridges of

¹ This piece was not levelled, and may belong to Aqua Claudia (*infra*, p. 218).

² Called *Fontanile delle Marmorelle* in earlier editions of the map.

Aquae Claudia and Anio Novus (I. 13), there was probably a *puteus*, for brick, cubes of *opus reticulatum*, and deposit are visible; while another, in the west branch of Valle Pignola, west of the stream, is marked in our map. There was also a *puteus* on Colle della Lite, marked by a heap of deposit south of point 138, not indicated in the map; and remains of a bridge in tufa ashlar, of which five courses remain, span the narrow, deep, eastern branch of the stream to the west of the hill, south of point 138, where a path crosses. This bridge is probably attributable to the Marcia; it is 1.60 to 1.70 m. wide; of the courses, two are 0.59 m. high, and the middle one 0.70 m., some headers being as narrow as 0.37 m., while one stretcher is over 1.50 m. long. A level was not taken, but it must lie about 110 m. above sea-level.

After the bridge, the aqueduct turns from south-west to 10° N. of W., and some fresh deposit, of very bad quality, has recently been found in the field here. The west branch of the stream is too shallow for it to appear. It must soon have turned farther north, and deposit indicates a *puteus* on Colle Mattia, some 50 m. north of Torre Iacova; indeed, the later ruins on this hill, at point 155 south of the Torre, are built of aqueduct-deposit.¹ A *puteus* still exists north-west of the east bank of the next stream, the Valle Forma Rotta, east of point 134; it is of *opus reticulatum*, measures 0.90 square, and shows that the direction of the aqueduct was 40° W. of N. Some 200 feet NNW., on the west bank, is a similar *puteus*, 1.60 m. by 0.90 m., with long sides running north and south. Both are marked in Map 4.

The course of the Marcia west of this point is again traceable with reasonable certainty by its deposit. Thus, about 50 m. north-west of Grotte Dama (*caposaldo* 57a) there was a large heap of thick fragments which looked as though they had been freshly excavated from the *specus*.² The aqueduct passed under Via Cavona, south of Grotte Piattella, and then ran due west for some distance. Its deposit is to be found north of the house marked *Micara* in the map; and a wall of *selce* concrete 1.30 m. thick, in the stream to the west, may be connected with it. Some concrete belonging to it is also visible in the track from Fonte Vermicino to Torre Nova.

West of this track is an aqueduct of many arches, originally about 60 m. long.³ Five complete arches and other isolated piers

¹ PBSR. i. 250.

² A *cippus* is wrongly marked on the map here. Nibby, in his manuscript notes at the British School (*Schede*, i. 113), mentions the existence of indications of the bottom of an aqueduct of *opus signinum* close to the ancient road which passed through Prata Porci (PBSR. i. 244). He marks it between the hills at the western extremity, so that it must have belonged to the Marcia if his observations are correct.

³ *Builder*, 204 and fig. 22; cf. PBSR. iv. 146, and pl. x, fig. 2.

PLATE VI



a. AQUA MARCIA: PONTE DELLA BULICA



b. AQUA MARCIA: LATE REBUILDING NEAR TORRE NOVA

are still preserved. There is little doubt that it belongs to the Marcia, though a very late restoration (Pl. VI *b*). It is built of concrete, containing large pieces of marble and aqueduct-deposit, faced with rectangular blocks of tufa; the putlog-holes are left open, and the arches are turned in two rings of tiles. In the best-preserved portion the piers are 1.84 m. thick and 1.70 to 2.00 m. wide, the span of the arches varying from 1.90 m. to 2.75 m. Farther east were at least seven more piers, while to the west there are two more high piers, one at the crossing of the stream being 2.75 m. wide. Still farther up the hill-side is a low arch. This aqueduct is marked in Fabretti's map¹ as *ductus aquae Argentianae, ut credimus*. He connects it, wrongly, with the small aqueduct north of Ponte di Sette Miglia on Via Tuscolana,² whereas there is a difference of over 30 m. in level between them.

More deposit exists some 350 m. south of Ponte Nuovo on Via Tuscolana, between the 11th and 12th kilometre stones: and south-west of this point, 300 m. NNE. of the Casalotto on Via Anagnina, the writer saw two *cippi* in position (see map), 0.48 and 0.55 m. wide, and 0.25 and 0.30 m. thick respectively; they were 4.8 m. ($16\frac{1}{2}$ feet) apart, measuring from their inner sides. The modern road crosses the aqueduct 50 m. from the 11th kilometre stone, and 64 m. from the Casalotto. The top of this stone is 94.76 m. above sea-level, so that the bottom of the *specus* can be put at about 93 m. There is much deposit in the road itself and in the field-walls, and it is likely that the *specus* was cut when the road was made. South-west of the road the aqueduct turns and runs west until it reaches Via Castrimoeniensis, now followed by the modern railway to Albano.³

In this stretch it keeps entirely underground; but its deposit and several pairs of its *cippi* have been seen to the north side of the Marrana Mariana. Beginning on the south-west side of the Via Latina, there is a pair of *cippi*, broken at the top, each 0.71 m. wide, 0.29 m. (1 foot) thick, and 8.55 m. ($28\frac{3}{4}$ feet) apart on the inside; while 5 m. to the west lies a heap of deposit, no doubt denoting a *puteus*. About 72 m. (240 Roman feet) farther west is another heap, with *cippus*, almost buried, 5 m. east of it. At 143.50 m. farther (just over 483 feet, or double the usual interval), is another pair of *cippi*, 0.29 and 0.37 m. thick and 7.60 m. (25 feet) apart on the inside; but no *puteus* was traced. A buried *cippus* found between the last two points was not, however, equidistant between them, and perhaps not *in situ*. No trace of inscriptions was visible on any, for their upper parts were gone.

¹ Diss. i, p. 5: 6, tab. i (cf. his second edition, p. 149).

² PBSR., cit. 140; pl. x, fig. 1. Ground-level here (see map) is 91 m., and the aqueduct c. 7.80 m. high. There it is 64 m. and the *specus* 3.50 m. above ground. This sector was not included in *Livellazione* because no *specus* existed to level.

³ PBSR. iv. 148.

West of these *cippi*, the sites of three more *putei*, at about the correct interval, may be traced; and 200 m. north of the Marrana the writer saw a *cippus*¹ of *peperino* standing in a field. The characteristic hole in it was, however, visible above ground, so that it may not have been *in situ*; for, farther west again, east of the point where the concrete of the Claudia becomes visible, though not quite on the same line as before, is another *cippus* (0.60 by 0.27 m.), standing within 12 m. of the Marrana, with a round hole, probably a *puteus*, to the south of it, and a large amount of deposit. Two pairs of heaps of deposit, probably marking sites of *putei*, occur, the first before reaching the embankment of the oldest line to Naples,² and the second between it and the Albano railway, in the field before the Bertone property (Map 2). Just inside the Bertone property the top of a *peperino cippus*, 0.50 m. wide and 0.23 m. thick, may be seen *in situ*, oriented 32° N. of W.: there are also large quantities of deposit everywhere about. Finally, by the side of the Marrana the base of another *cippus* is lying loose; it measures 0.60 m. by 0.45 m. and 0.22 m. thick, and is pierced with the normal hole, 0.15 m. in diameter.³

At the point where the Aqua Marcia turns north-west, the Tepula and Iulia must lie close to it. Separate *cippi* of the Iulia, together with its channel, were found in 1887.⁴ The first two pairs of *cippi* did not coincide with the *putei*, for they were set regularly at every 240 feet, while the *putei* were placed wherever convenient. Yet, in the easy country now traversed, one would have thought that an effort might have been made to secure coincidence.⁵

(f) *Capannelle to Rome. Aquae Marcia-Tepula-Iulia. Map 1.*

Frontinus notes that both the Marcia and Iulia, from the 7th mile to Rome, ran for the first 528 paces (784 m.) on substructures, the remaining 6,472 paces (9,611 m.) being on arches. From II. 6 (*caposaldo* 37) it is 7,825 m. to II. 1 (*caposaldo* 8), still over 500 m. from Porta Maggiore; and the divergence of the Marcia from the straight line, near Roma Vecchia, further increases its length as compared with Aqua Claudia. The levelling could not be carried along the line of the Marcia itself, for in 1915 no remains of it were visible near II. 6. Frontinus does not actually state that the arches of the Marcia also carried the Tepula and Iulia, but they did in fact run superimposed from the point of their emergence from the ground;

¹ It was 0.50 m. wide, 0.25 m. thick, and 0.48 m. high down to the hole, which was 0.15 m. in diameter.

² See p. 230, n. 2, for a definition of those oft-changed railways.

³ The description of what I saw in previous years in such minute detail can only be excused by the fact that the spread of cultivation will soon cause every trace to disappear.

⁴ See p. 164.

⁵ The discrepancy is no doubt due to the fact that the *cippi* were not set up until the aqueduct was finished. The *putei* were intimately connected with the tunnels. Ed.

JUNCTION WITH AQUAE TEPULA AND IULIA 129

underground, near Casino Bertone, the Iulia was still running independently. Thus, Van Buren's remark¹ about 'the important point near the seventh milestone where Tepula and Julia started on their course above ground, in separate channels, first on substructures and then above the course of the Marcia' is due to a misunderstanding. When they emerge on substructures all three aqueducts have already come together and are running on top of one another.²

The joint *cippi* of the three aqueducts, recorded after their emergence together in the neighbourhood of Capannelle, are as follows:

	Number.	Interval (in feet).	In situ or not.	Place of Publication.
<i>a, b</i>	103 (two)	240	Yes	<i>CIL.</i> vi. 31561 <i>k, l</i> ; Lanciani in <i>Not. Scavi</i> , 1890, 117.
<i>c</i>	82	240	?	<i>Bull. Com.</i> , 1899, 39.
<i>d</i>	75	240	No	<i>CIL.</i> vi. 3161 <i>i</i> = 1249 <i>i</i> ; Fabretti, <i>Inscr.</i> 661, 510 (where it is said to have been 590 paces, about 2,900 feet from no. 63, i.e. 12 × 240').
<i>e</i>	73	240	?	<i>CIL.</i> vi. 31561 <i>h</i> = 1249 <i>g, h</i> ; Amati, <i>Giorn. Arcad.</i> xxiv (1824), 85.
<i>f</i>	71	240	Yes	<i>Bull. Com.</i> , 1905, 289; <i>Class. Rev.</i> , 1905, 330.
<i>g</i>	70 (?)	240	?	<i>CIL.</i> vi. 1249 <i>g</i> (?); cf. p. 3126.
<i>h</i>	63	240	No	<i>CIL.</i> vi. 31561 <i>g</i> = 1249 <i>f</i> ; Fabretti, <i>De Aquis</i> , 115, 107; <i>Inscr.</i> 661, 509.
<i>i</i>	54	240	?	<i>CIL.</i> vi. 31561 <i>f</i> = 1249 <i>e</i> .
<i>j</i>	51	240	?	<i>CIL.</i> vi. 31561 <i>e</i> = 1249 <i>d</i> ; Amati, <i>cit.</i>
<i>k</i>	30	240	?	<i>CIL.</i> vi. 31561 <i>d</i> = 1249 <i>c</i> .
<i>l</i>	25	240	?	<i>CIL.</i> vi. 31561 <i>c</i> = 1249 <i>b</i> .
<i>m, n</i>	24 (two)	240	Yes	<i>Not. Scavi</i> , 1913, 7; <i>Bull. Com.</i> , 1912, 233.
<i>o</i>	5	240	?	<i>CIL.</i> vi. 31561 <i>b</i> = 1249 <i>a</i> .
<i>p</i>	2	425 (402)	?	<i>CIL.</i> vi. 31561 <i>a</i> = 1249 α (p. 848) = <i>EE.</i> iv. 808; Lanciani, <i>Bull. Com.</i> , 1876, 136, 173; Lanciani, 93: 305.

All bear the inscription MAR(cia) TEP(ula) IVL(ia) IMP(erator) CAESAR DIVI F(ilius) AVGVSTVS EX S(enatus) C(onsulto), and all are of travertine.

The floor of the *specus* of Aqua Iulia was visible about thirty years ago near *caposaldo* 37 (II. 6), where the branch aqueduct to Sette Bassi (*caposaldo* 38) diverges; and the writer has seen the roof of the Tepula, in tufa concrete, south of the cross-road from the Via Appia Nuova to Via Latina, opposite the northernmost building of the racing-stables at Capannelle. About one hundred yards north of *caposaldo* 37, agricultural operations have recently brought to light the superimposed channels of Aquae Tepula and Iulia, in a

¹ *JRS.*, xv (1925), 128.

² The question might, indeed, be raised whether the roofing of the Aqua Marcia, which became the base of the other two, was originally a sound roof; for flat coverslabs in the stretch of original arches near Roma Vecchia, presently to be described, would undoubtedly have held rain-water in a somewhat undesirable manner; but there is no evidence for any contrivance to allow the water to run off.

little ditch south-west of a small reservoir faced with external niches.¹ A sight taken with a hand-level showed that the bottom of the *specus* of the Iulia was 0.80 m. below the *caposaldo*, or 70.789 m. above sea-level; it was 0.59 m. wide, with walls of Augustan *opus reticulatum* 0.45 m. thick, reinforced with late brick² walls 0.43 m. thick; and it was undoubtedly running just above ground-level. The *specus* of the Tepula was 0.57 m. wide, with a low pointed vault set on planks, rising 0.23 m. above the spring; it had walls of rough concrete, clearly intended to be underground, and were 0.73 and 0.85 m. thick, respectively. The intrados of the Tepula was only 0.30 m. lower than the bottom of the Iulia, or 70.489 m. above sea-level; but neither the bottom nor any part of the Aqua Marcia was visible. The size and method of construction of the two visible *specus* make their identification quite certain; and, allowing a height of 1.17 m. for the Tepula, a floor 0.25 m. thick below it and 1.34 m. for the height of the Marcia, we get a level of 69.319 m. for the floor of the Tepula and of 67.729 m. for the bottom of the Marcia.

The bank formed round the *specus* of Aqua Iulia was always traceable and had been marked in the map; but the spread of cultivation has led to considerable destruction of its walls. Some portions of the original west wall, in *opus reticulatum* on a base of small rectangular blocks, are still to be seen, together with considerable remains of the outer strengthening-wall of brickwork. There is also plenty of the characteristic deposit of the Marcia, though it is not possible to fix down the *putei*. The remains can be traced for about a kilometre,³ as far as the cross-road which runs south-west to our *caposaldo* 31, after which they have been robbed for the Acqua Felice.⁴ By this modern road the writer has seen a brick buttress, at the turn near the house marked 63 m. above sea-level, and also a shaft of Aqua Iulia, square outside and round inside, close to the road, just before the arches immediately to be described; but these are not now visible. There is, however, a small piece of the concrete which belonged to the right-hand side of the Tepula to be seen on the left of the avenue to Casale Roma Vecchia. After crossing the road ten arches of the Aqua Marcia

¹ PBSR. iv, Map 1, and p. 110, n. 1.

² The stamps were CIL. xv. 1097 d (A.D. 75-108); an unidentified stamp of A.D. 123 on a *bipedalis*, with hollow letters APRONIAN | II AVG SVLP; a stamp with large letters in relief CAN D F NIAT, also unidentified.

³ If the figures given by Frontinus for Aqua Iulia (528 paces on substructures and 6,472 on arches) are to be explained, we must suppose that almost the last half of this stretch was already on low arches.

⁴ Lanciani, *Sched. Vat.* 37, f. 45, notes that the actual channel of the Felice is modern, incredibly tortuous and irregular in section. It has an ogee vault, is 1.30 m. high, 1.50 m. wide, excavated in hard earth or tufa, and lined with cement 0.03 m. thick. It often cuts through the foundation walls of ancient villas.

occur, and the spring of an eleventh. These are original, 6.65 m. from centre to centre, each with fifteen voussoirs 0.65 m. high.¹ The voussoirs and moulds are of *peperino*, the spandrels of yellow tufa resembling Grotta Oscura. The walls of the *specus* are built in three courses of dark-red tufa blocks, 0.54 m. high and 0.51 m. wide, laid lengthwise:² they rest on a string course 0.27 m. high. The channel is 1.35 m. high and 0.71 m. wide inside, excluding a cement lining, not always preserved, 0.025 thick on the sides and 0.38 m. thick at the bottom; the cover-slab is 0.25 thick and 2.08 m. wide.³

The side walls of the Tepula's *specus* were not set over those of the Marcia, but rather to one side; for the *specus* is a good deal narrower. Thus, the north-east wall, about 0.40 m. thick, of concrete faced outside with *opus reticulatum* (the original inner lining is not preserved), lay 0.75 m. within the edge of the Marcia. If the other wall was also 0.40 m. thick, the *specus* was 0.52 m. wide. The total height was not more than 1.85 m. above the Marcia's cover-slab; so, allowing 0.25 m. for the cement at the bottom of the *specus*, and 1.17 m. for the height of the channel,⁴ we get 0.43 m. for the thickness of the extrados, above which the *specus* of the Iulia would have begun. At a very late period concrete faced with bad brickwork, 0.75 m. thick, was added outside the north-east *specus* wall, filling out the space to the very edge; while the Marcia *specus* received, below its cover-slab, which projects 0.18 or 0.20 m., a similar reinforcement 0.55 m. thick, which supports an occasional buttress in the upper wall. The upper wall is preserved to a height of 2.80 m., of which 0.95 m. must therefore belong to a reinforcement of the Iulia, whose original *specus* wall has entirely disappeared. Ten metres from the north-west end there is a vent-hole through the wall from the *specus* of the Tepula, 0.78 m. wide and 0.80 m. high, with a gabled roof another 0.65 m. high. The Tepula's *specus* was placed in the way described because it had less water to carry. Too large a channel would make the water stagnate, yet reasonable head-room was required for the cleansing staff; thus, the channel was made here and elsewhere (cf. Fig. 14 and Pl. VII *b*) a good deal narrower than the Marcia's. Structurally, this arrangement was bad: the right-hand wall and the greater part of the weight of the *specus* were

¹ The measurements are given by Lanciani, 87: 299, cf. *Sched. Vat.* 37, ff. 45, 46. It is also illustrated by Fabretti, 17: 16, tab. vi.

² Like Anio tufa: in places the tufa of the uppermost courses is full of cinders, like that of Fidenae. There is sometimes a line of *peperino* blocks.

³ Lanciani (*loc. cit.*) refers to it as 'largo 0.90' which means the measurement taken along the course of the aqueduct.

⁴ According to Sallustio Peruzzi's sketch (*Uffizi*, 648; reproduced by Bartoli, *Mon. Rom. Dis. Uff.*, vol. iv, pl. 395, fig. 707) it was 5 palms high and 3 palms 3 oncie wide (1.12 by 0.72 m.).

carried by the left-hand wall of the Marcia; while the left-hand wall rested only on the cover-slabs of the Marcia, and fractured them in many places.

At the south-east end of this stretch of ten arches there is an ashlar buttress on the south-west side, enclosed in later concrete, faced with *opus mixtum*; while at the north-west end there is an original ashlar buttress, on the north-east side. This was heightened when the *specus* of the Tepula was added, and later enclosed in a Flavian buttress, dated by Dr. Van Deman: subsequently, the masonry fell out above the level of the Marcia, and was replaced by very late concrete; and at the same time a concrete buttress, faced with brick, was added on the south-west, where no trace of an original buttress is to be seen. This is the spot illustrated by Lanciani.¹ The vertical slots cut in the blocks of the Marcia are 0.06 m. wide and 0.02 m. deep, and still show traces of the cement run into them in order to seal the joint.² Here also, in the roof of the Aqua Marcia, is a plug-stone as drawn by Sallustio Peruzzi, and noted by Lanciani;³ its lower diameter is 0.47 m.

After a short interval comes another stretch of eighteen arches, exactly resembling those already described. At the north end of it, just opposite Casale Roma Vecchia, calculating from a level marked on the Acqua Felice (61.69 m.), the bottom of the *specus* of the Marcia, at 1.28 m. above this, lies 62.97 m. above the sea. Since the Marcia *specus*, 0.76 m. wide, is 1.35 m. high with a cover-slab 0.25 m. thick, the bottom of the Tepula is⁴ at the 64.82 m. level, that of the Iulia being about 1.60 higher, at 66.42 m.

A gap now extends, up to the road from Casale Roma Vecchia to Via Tuscolana, in which the Acqua Felice has completely destroyed the ancient works.⁵ After crossing the road, it becomes plain that the Acqua Felice has included the bases of the piers of Aqua Marcia between those of its arched substructure. They are visible on the south-west side of it, built in well-laid headers and stretchers of dark Anio tufa, with extremely thin joints.⁶ These are original, and have been enveloped by Titus in Flavian concrete, faced with *opus reticulatum*, with a brick string-mould on the outer edges; while under Hadrian, concrete in *opus reticulatum* and

¹ *Ruins and Excavations*, p. 22, fig. 52 (from a Parker photograph).

² This is the meaning of his expression *innestate con cieche*, 87 : 299.

³ *Sched. Vat.*, *cit.* He first (87 : 299) denied their existence, which had been asserted by Canina (v. 66); but observed them in 1882 (see *Herschel*, p. 149).

⁴ $62.97 + 1.35 + 0.25 + 0.25$ (for the cement layer at the bottom of the Tepula) = 64.82 m.

⁵ There is a small reservoir in *opus reticulatum*, with stone and brick quoins, on the south-west just before reaching the road, which must have been supplied by one of the three, though which it is impossible to say. It is shown in map i. of *PBSR.* iv, and is mentioned (p. 80) as a 'reservoir of *opus reticulatum* with two chambers', which it certainly once had.

⁶ For further constructional particulars, see Dr. Van Deman's work.

brick closed up the arch completely.¹ The interval between the piers was originally 5.40 m., or 7.50 from centre to centre.

At the last pier before the aqueduct turns to run almost due west, to the south of Ruderì Le Vignaccie, the original impost-mould is visible. On the north-east, close to the branch road to Via Tuscolana, there is an ashlar buttress; otherwise all is enclosed in late brickwork. At the fifth arch beyond this buttress are two piers of small rectangular tufa blocks, with an occasional course of bricks and brick string-moulds, which must belong to a branch² running due north, taken direct from one of the aqueducts. The interval between the two piers is 4.05 m., that nearest the aqueduct being 3.10 m. wide, the other 1.80, while both are 1.80 m. thick.

Beyond the turn, the Acqua Felice has included two fine pieces of concrete with Hadrianic brick-facing, visible on the south side. On the north, opposite the villa of Le Vignaccie, there is some late concrete, while in a ditch between the *piscina* of the villa and the aqueduct, walls of uncertain purpose were discovered.³ The *piscina* lay 4.50 m. (15 feet) away from the aqueduct, evidently at the edge of the reserved strip of 30 feet.

The large villa at Le Vignaccie has already been described by the writer both alone⁴ and with Lugli.⁵ Fabretti says that these ruins belonged to the Astalli family.⁶ He gives a description and plan of the larger *piscina*, which was a two-storied pentagonal structure,⁷ the lower containing three chambers divided by ruined partition-walls that had once supported the upper floor. The upper story had four chambers, the third being large. It is built of concrete, faced partly with *opus mixtum*, partly with *opus reticulatum*,

¹ We may attribute to one of these reinforcements rather than to the Villa, which has not as a rule such early stamps, an example of *CIL.* xv. 1075 a, of A.D. 100-25, which I found in 1899 in the field-walls east of Le Vignaccie.

² See *PBSR.* iv. 78: the necessary conclusion that this was a branch may now be stressed more strongly than then.

³ *PBSR.* iv. 78. 'In the space . . . ran a pathway, and this . . . was flanked on the N. by a *reticulatum* wall, 0.65 m. thick. On each side of, and somewhat farther away from, the aqueduct, ran a *reticulatum* wall, about 0.50 m. thick. These two walls were not parallel to the aqueduct (though they were to one another), but ran a little E. of N., about 16 m. apart. They came to light in digging a drainage ditch just to the west of the *piscina*. Their purpose is quite uncertain, and their orientation, divergent from that of the other buildings adjacent, is curious: but it seems quite impossible to suppose that they belong to a period previous to the construction of the aqueduct.'

⁴ *PBSR.* cit.: *Memorie dell' Accademia Pontificia*, ii. 183, with Lugli.

⁵ Seeking to associate with it discoveries recorded at Quadraro by the engraver Volpato, in 1780. At that time the *tenuta* of Quadraro belonged to Prince Barberini of Palestrina, but it had previously been the property of the Astalli.

⁶ *De Aquis*, 119: 111 (cf. Diss. ii, tab. xv). He calls the farm 'dello Spedaletto' and refers to the ruins as Cento Celle; how rightly, I do not know, for the name Cento Celle is generally placed farther north.

⁷ See *Memorie*, cit., where I revised a little my former account. [Fabretti's ingenious but erroneous version has been suppressed here as irrelevant. Ed.]

partly with small rubble only; the arches have alternate brick and tufa voussoirs, and *amphorae* are used to lighten the walls of the upper story. Fabretti supposed that this was the filtering-tank of the Marcia mentioned by Frontinus. This is wrong,¹ though the deposit resembles that of the Marcia. A stamped brick² found in the shaft in the roof of the central chamber belongs to A.D. 123. The exterior of the cistern has niches on the sides towards the open country, but not on those towards the aqueducts.

The foundations of the arches of the Aqua Marcia and the heaps of deposit cleansed from the channel have broadened the neck of land connecting Roma Vecchia with Tor Fiscale, though this neck must originally have been wide enough to take the underground channel of the Anio Vetus. The point was also selected by Pope Calixtus II for the passage of the Marrana Mariana, which runs to the south of the Marcia.

In cutting through the neck for the railway to Naples in 1890, interesting discoveries were made, described by Lanciani.³ The piers of the Marcia were founded on concrete, rising 2.30 m. above the railway-level (58 m. above sea, and 6,975 m. from the central station), retaining the vertical slots formed by the uprights of shuttering: the top of the foundation lay at 60.30 m. above the sea. The piers, measuring 4.00 m. by 4.70 (long) and now standing 2.30 high, were sheathed in excellent brickwork up to the modern ground-level. The original piers⁴ were 2.70 m. wide and of yellow tufa. On each side of them traces of the reserved strip were recognized; it is bounded by a *reticulatum* wall, and the ground is beaten hard and spread with the calcareous deposit of the Marcia, like a country path. There was also found a pair of travertine *cippi*, numbered 103, 1.44 m. high, 0.50 wide, and 0.25 thick: they were hammer-dressed above ground and left rough in their buried third. The inscription faced the arches. Their backs were 3.60 m. from the face of the piers, bounding thus a space of 11.20 m. (c. 38 Roman feet) wide. The inscriptions, facing the piers, contained the usual Augustan formula.⁵ Near the second *cippus* were found six coins of Augustus, one perhaps of Antonia, and one of Gaius.⁶

Between the old and new railway-lines, north of the aqueduct, is a downward shaft faced with Hadrianic brick and *opus reticulatum*,⁷ 0.83 m. square inside: it communicated with a *piscina*, planned by Fabretti,⁸ and probably the supply-tank for some villa,

¹ Lanciani, 81: 293.

² CIL. xv. 1913.

³ Lanciani in *Not. Scavi*, 1890, 116, who gives a sketch in elevation and section.

⁴ *Sched. Vat.* 37, f. 41.

⁵ CIL. vi. 31561, k, l. See above, p. 129.

⁶ In *Sched. Vat.*, *cit.* he adds two tiles (from late tombs?), CIL. xv. 686 (end of 2nd cent. A.D.) and CIL. xv. 1289 (A.D. 123).

⁷ Not 'brick' alone, as I stated in *PBSR.* iv. 74.

⁸ *De Aquis*, 112; Diss ii, tav. xvi; as Lanciani, 86: 298, has pointed out, it can have

but certainly not a clearing-tank for any of the main aqueducts, as Fabretti thought. The *piscina* is of *selce* concrete, and trapezoidal in shape, measuring externally 6 m. (south, towards the aqueduct) by 7.3 m. (east) by 7.8 m. (west) by 2.30 m. (north). On the roof is a light-shaft, about 0.60 by 0.90 m., and in the centre of the north side is a terra-cotta outlet-pipe. Fabretti notes broken walls suggestive of other chambers connected with it; but no trace of these is now visible, and the fact that the concrete is unfaced may indicate that the reservoir was originally subterranean.

The masonry of Aqua Marcia and some fallen masses of later strengthening in concrete were found in making the new railway to Naples in 1918; and two or three blocks have been left *in situ*¹ in each pier of the overbridge of the Acqua Felice, that on the east showing heavy bossing, as at Ponte S. Antonio. The *peperino* impost-mould of the Marcia, with tufa blocks below, can be seen where the Claudia crosses it for the first time;² also a late brick reinforcement, which must, as at Roma Vecchia, reach up as far as the *specus* of the Iulia. The Marrana runs under the new line in a siphon.

In the stretch between this railway-line and Tor Fiscale, where the neck of land ends, Domenico Fontana's method of using the Marcia to carry the Felice becomes clear. His larger arches do not run from one original pier to another, but from one brick face of the concrete reinforcement to the next; hence the apparent irregularity noted by Lanciani.³ In the Marcia itself may also be noted the economy of material achieved by using softer, light-brown tufa for the core of the piers, and the harder, dark-brown variety for the exterior.

There are two cisterns⁴ in this sector, of which both must have been supplied by the Marcia.⁵ One is built against the bank, and only the lower wall can be seen, with four external buttresses, all faced with *opus reticulatum* and brick-bands: the other is just below an obtuse angle in the Marcia (closely followed by the Felice), where there is an extra pier at the turn; it is rectangular (about 7 by 8 m.) with two external buttresses on each side, faced with brick and *opus reticulatum*; and a terra-cotta pipe is still preserved on the south side. Lanciani saw it in better order, for he

nothing to do with the *piscina* of the Aqua Iulia; and indeed, to judge from the character of the deposit on the sides of the shaft, it was probably supplied by the Aqua Marcia.

¹ Two of them measured 0.65 by 1.29 m. and 0.59 by 0.93 m.

² See p. 231.

³ Lanciani, 87 : 299; *Sched. Vat.* 37, f. 48.

⁴ Parker, *Historical Photographs*, 896 (cf. 1028, 1029), shows 'the remains of three *piscinae* at least' (PBSR. iv. 70), all of which he wrongly attributes to the Anio Vetus (Aquaducts, 116 bis).

⁵ Lanciani, 88 : 300; *Sched. Vat.* 37, ff. 44, 45 (with sketch plans of the two reservoirs on f. 44 (13. v. 1879), and of the obtuse angle on f. 45 (31. xii, 1902) with the down-shaft, which he does not describe elsewhere).

describes it as having 'its walls pierced high up with terra-cotta pipes for ventilation' whereas it is now hardly preserved above ground-level. It was supplied from the aqueduct by a vertical shaft, measuring 0.94 by 0.92 m. inside, with walls 0.43 and 0.45 m. thick, faced with *opus reticulatum* inside, and bad, late brick outside. The deposit on the sides is from 6 to 10 cm. thick.

The Marcia-Tepula-Iulia is crossed for the second time at right angles by Aqua Claudia at the Tor Fiscale, erected over the crossing (Fig. 14). One arch of the original construction, without later reinforcement, is well preserved inside the tower.¹ The Tepula exhibits a brick *specus*, perhaps Claudian, and a late restoration, and is covered, exceptionally, by a stone slab. The Iulia's concrete *specus* is faced on each side with brickwork of Septimius Severus,² and buttressed externally.

From Tor Fiscale to Porta Furba, 1,350 m., the Marcia continues to carry the Acqua Felice.³ There are no remains of importance. In this stretch a normal *cippus*,⁴ numbered 82, was found in February 1824. The neck of land is here so narrow that there is hardly space for all the aqueducts. The normal strip of 30 feet, which legally belonged to each one, was replaced by a service road,⁵ 4.10 m. wide, including kerbs. In taking the Marzana Mariana under the electric tram line, it was found that this road had been used as a bed for that stream, later choked with 3 m. of silt.⁶ After Porta Furba this road is marked by the modern Vicolo del Mandrione. The Acqua Felice continues to run on top of Aqua Marcia for a few arches only; in the base of its piers some Diocletianic brickwork may be seen, while the last but one exhibits tufa ashlar: it then crosses the Vicolo del Mandrione, close to the fountain of Clement XII, and runs upon the Severan strengthening-wall of Aqua Claudia.⁷ Fifteen arches of Aqua Marcia then followed, of which nine must have been where the hedge now is. Where our plan (Fig. 23) begins, there are scanty traces of the concrete

¹ On the pier outside the tower is *caposaldo* 23 (57.797 m.); one of the blocks of the course just below it has a joint which is not perfectly vertical, and this may indicate, together with the height of the blocks (0.45 m. and 0.35 m.) that we are in the presence of the original construction; cf. *Röm. Mitt.*, 1908, 18-20, for similar work in the Porta S. Maria, at Ferentino. The bottom of the Marcia is 4.30 m. above it (62.097 m.), that of the Tepula 2 m. higher (64.097), and that of the Iulia (65.597) 1.50 m. higher again.

² Identified by Dr. Van Deman.

³ Two brick stamps recorded as found in the latter a kilometre outside Porta Furba, and belonging to the time of Hadrian (*CIL.* xv. 582b, 6; 1838f, 11) must originally have been used in the facing of concrete reinforcements of the Aqua Marcia or Aqua Claudia.

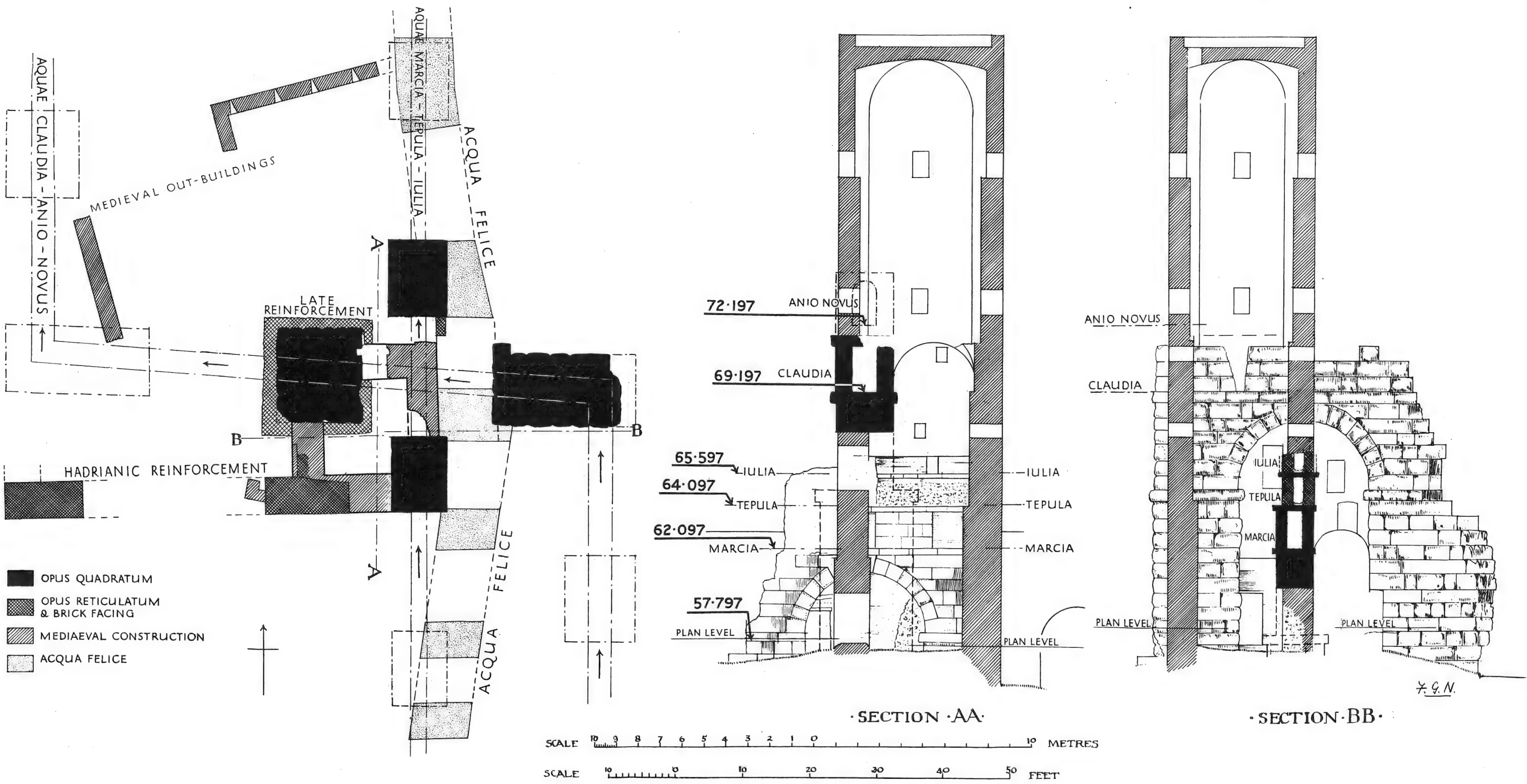
⁴ It has not found its way into *CIL.*, though re-erected on the spot and still there, and was published first by Lanciani, from an epigraphic manuscript in his library, in *Bull. Com.*, 1899, 39 (no further details are given).

⁵ Lanciani, *Bull. Com.*, 1905, 289-93.

⁶ *Sched. Vat.* 37, f. 48.

⁷ Lanciani, 88: 390, had believed that this brick wall was the aqueduct of the Marcia-Tepula-Iulia: but his plan (in *Bull. Com.*, *cit.*, 290 fig. 1) is better. It begins (as regards the Marcia) with our eleventh pier.

FIG. 14
AQUAE MARCIA-TEPULA-IULIA, CLAUDIA-ANIO NOVUS & ACQUA FELICE AT TOR FISCALE



reinforcement of two only (see section C C, where the concrete is faced with very late brickwork). The Acqua Felice then crosses the road again, and there follow twelve piers of Aqua Marcia. The first exhibits some of the original ashlar in grey-yellow tufa with almost invisible joints, as used in this stretch for foundations and superstructure but not for piers and arches, these being built in the harder reddish grey-brown tufa, heavily bossed, as in piers 10 and 11. The second and fourth arches,¹ built in this material, can be seen under those of the Acqua Felice; while in the third and eleventh piers may be noted a travertine string-course. In the third pier, a brick-faced concrete reinforcement, carried out on to the buttresses, may be attributed to Titus;² while there are also indications of underpinning by Hadrian.

But the main repairs ('first reinforcement to Marcia' in Fig. 23) are due to Diocletian, who sheathed the piers in brick-faced concrete. This is not preserved above its travertine footing on the west (next to Vicolo del Mandrione), being replaced by the plastering of the modern Acqua Felice. On the east from the fifth pier onwards, still later facing³ has been substituted from the footing upwards, and the arches, as the plan shows, have been again filled with inferior brick-faced concrete. Both in Diocletian's time and later, the work on this side projected up to the spring of the arches; and this was probably so on the other side also.

After the eleventh pier, where is an entrance to the yard of a modern house (Fig. 23) comes one more pier in which the original ashlar can be fairly well seen: but the last pier before the crossing is completely concealed by modern work, and the reinforcements on each side of the crossing are late, the ashlar being almost entirely concealed by a late arch.⁴ The Acqua Felice then crossed to join the Aqua Claudia, which it followed from this point into Rome. The Aqua Marcia also crossed the road,⁵ and went straight

¹ The latter is considerably set back from the pier.

² Dr. Van Deman (and for what follows).

³ I. A. Richmond assigns work like it at Porta Appia to the fifth period, before Belisarius. The distinction between the two types of facing can be very clearly seen in one of Mr. Swain's photographs, T 126, reproduced by Dr. Van Deman.

⁴ *Builder*, fig. 26.

⁵ The narrowing of the roadway to 3.25 m. here is explained by the fact that the brick arch is very late (Lanciani, *Sched. Vat.* 37, f. 93; cf. 1. vi, 1905). The road besides the *crepidines*, or edging-stones, had a low wall on its east side, which had fallen over. These or other discoveries are referred to by Vaglieri (*Not. Scav.*, 1907, 288), in an account neither detailed nor clear: 'remains of walls, with brick facing, in *opus reticulatum*, and of tufa blocks, for a length of about 130 m., have come to light in the excavation made by Sig. Giuseppe Lolli at 60 m. from the arch by which the Acqua Felice crosses the road, near the *casello* of the Naples railway.' The preceding paragraph runs as follows: 'In the Vicolo del Mandrione, almost opposite point no. 1 of the second aqueduct (the allusion is not clear) at 10 metres below the ground-level a large tunnel, 17 metres wide, has been found, which runs for 10 metres under the aqueducts. Another like it appears in a second excavation close by.' The allusion is, most probably, to a group of quarries which were found

on from this point, as is shown by a pier (C) in which a little original ashlar appears, reinforced in brick-faced Flavian concrete.¹

No more remains occur for 120 m., when we come to the concrete reinforcement of a pier, the ashlar nucleus of which has disappeared. Close to this was found, in position, *cippus* 71, re-erected in a modern house near by. It measures 1.70 m. high, 0.55 m. wide, and 0.20 m. thick;² the inscription faced the road, and the *cippus* must have been about 5 m. from the centre of the *specus*. To this stretch also belong the 70th, 73rd and 75th *cippi*.³

A tufa pier of the Aqua Marcia was found in making the military road which crosses Vicolo del Mandrione. It measured 3.55 by 4.00 m., and two courses of blocks remained, resting on the virgin rock (*cappellaccio*),⁴ at a distance of 24.70 m. from the Aqua Claudia. Nothing has been visible since 1908. Twenty metres farther on, when the Albano railway was made in 1890, a pier of the Aqua Marcia, which had not previously been visible, was found⁵ on the south-east of the line, with three courses of stone resting on virgin soil; but, again, all traces have now disappeared. At the same time the ancient road corresponding to Vicolo del Mandrione was noted, 3.80 m. (13 Roman feet) wide, on the north-east side of the Claudia, at 1.30 m. below ground-level; while between it and the Marcia, an interval of 26.40 m., six late tombs formed of tiles were found.⁶

On the north-west side of the railway comes a very fine piece of the Marcia-Tepula-Iulia (Pl. VII *a*) consisting of ten arches and eleven pillars;⁷ the ashlar of the last pier has been removed, but the concrete reinforcement is still present. In the arch nearest the railway the original construction is clearly visible, and has been studied by Delbrück.⁸ The foundations have since been exposed, the lowest course formed by two blocks of grey-yellow Grotta under the Naples line at this point, and had to be filled up at considerable expenditure of time and money.

¹ Lanciani's plan in *Bull. Com., cit.*, does not seem to account for the facts so well in this or in other respects.

² Lanciani, *cit.*; Gatti in *Not. Scavi*, 1905, 406 (who also gives a plan); *Class. Rev.*, 1905, 330.

³ The 73rd was found, according to Fabretti (*Inscript.* 661, 510) about 590 paces from the 63rd; while the 75th is noted as having been discovered 'sotto la strada che dall'odierna tuscolana diverte a destra e reca a Grottaferrata, ed indi al Monte Albano, la quale esser dovea l'antica Latina dell'eferie' (Amati, *Sched. Vat.*; cf. *Giorn. accad.* xxiv (1824) 85), i.e. on the farther side of the Porta Furba. I can see no reason for identifying the 70th, recorded by Visconti, with the 75th, as some authorities do.

⁴ Lanciani, in *Not. Scavi*, 1882, 66; *Sched. Vat.* 37, f. 47 (sketch made on 2 Feb. 1882).

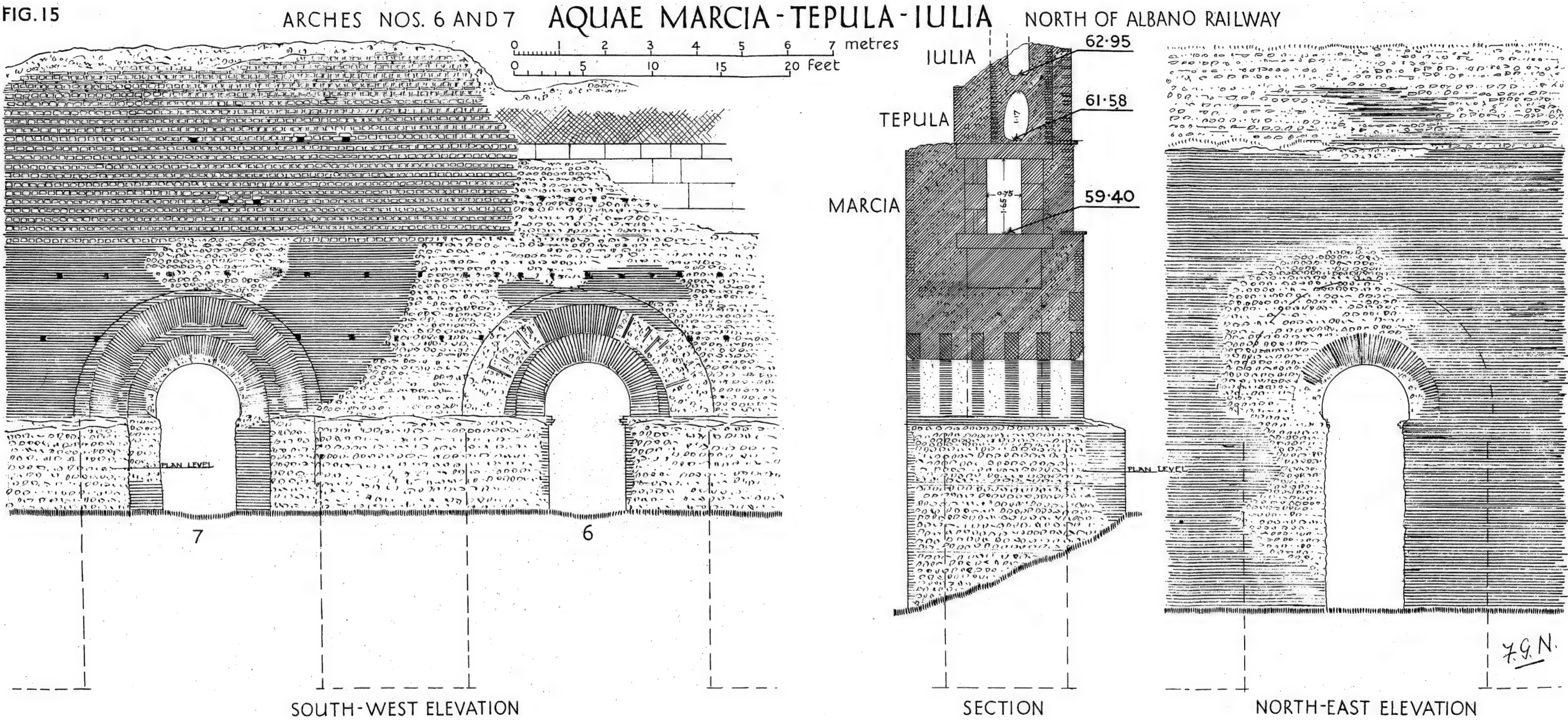
⁵ Lanciani, *Not. Scavi*, 1890, 12.

⁶ Almost all bore the stamp *CIL*. xv, 1068a (A.D. 145-55), one had *ibid.* 367 (period of M. Aurelius), see p. 239.

⁷ Described in Lanciani, 89: 301, as consisting of eight arches and 9 pillars entirely of brickwork.

⁸ *Hellenistische Bauten*, i. 1 and pl. i: Tenney Frank, *Roman Buildings of the Republic*, 139-41.

FIG. 15



Oscura tufa 0.60 m. and 0.53 m. high, while the remaining eight courses of the foundation and of the base of the pier are of reddish grey-brown tufa. There is no impost-mould; but the pier narrows from 2.66 to 1.60 m., and the remaining seven courses up to the *peperino* string-course below the *specus* are of grey-yellow tufa, except the voussoirs in grey-brown. The arches have a span of 5.35 m., and the piers are 3.25 m. long. The exterior was plastered, whether anciently or not is uncertain, though no plastering has been noted elsewhere. Only part of the *specus* of Aqua Marcia is preserved at this end, though soon both it and that of the Tepula appear; but they can be studied better farther north. After the second arch, the reinforcements in concrete which once enclosed the whole structure begin to be better preserved; indeed, no ashlar can be seen after the third pier.

Three periods of reinforcement can be clearly seen, the first attributable to Titus, the others to late periods. Titus appears to have enclosed the piers completely, but whether he also sheathed the *specus* is uncertain; for his work is not now preserved above the base of the Marcia's *specus* (Pl. VIII a). The later reinforcements on the south-west side, as best seen at the sixth and seventh arches¹ (Fig. 15), consist of refacing the lower part of the concrete walls; repairs to the arches, within which smaller arches were later added;² and the addition of a stone face from below the *specus* of the Marcia to the top of the aqueduct. The period to which this belonged is uncertain. On the north-east side, the whole of the Flavian work is almost completely concealed by very late brick-faced concrete, which extends under the Flavian arches, almost blocking them. This state of affairs is best seen in section at the end of this sector. The masonry *specus* of the Marcia is accessible, being 1.65 m. high, 0.75 m. wide, and lined on each side with cement, 0.03 m. thick. Above its *peperino* cover-slab, 0.32 m. thick, is the *specus* of Aqua Tepula, again placed asymmetrically, with one side-wall reconstructed in Augustan *opus reticulatum*. This has cracked the slab below it, as might have been expected, and the late restorers of the north-east side of the aqueduct placed a mass of brick-faced concrete as a counterpoise to restore the balance. Only the bottom of the *specus* of Aqua Iulia is preserved; it must have been reconstructed with the Aqua Tepula. The bottom of the *specus* of Aqua Marcia was levelled³ at 59.40 m., that of the

¹ All the holes shown in the elevation are putlog holes, except those in the *specus* of the Tepula, which seem to occur at regular intervals.

² Here, and here only, we get two different periods of late brickwork.

³ III. 2 (*Livellazione*, p. 19, fig. 6, where the lines are wrongly placed): *caposaldo* 16 was fixed two courses below the point where the pier narrows, and was at 54.259 m., the distance between the two points in Delbrück's elevation is 5.10 m. (a difference of 0.04 m. only from our calculations); 60.58 is a misprint.

Tepula at 61.58 m., and of the Iulia at 62.95 m. Hereabouts *cippus* 63 is recorded by Fabretti¹ as '*in vinea Bartholomaei Virginii, duobus milliariis, stadio minus, a porta maiori, et inter rudera arcuum Marciae et Claudiae*'. It lay about 590 paces from *cippus* 75, and thus almost *in situ*, for the proper distance between the two would have been 576 paces (2,880 feet).

The aqueduct is now completely removed for about a kilometre. In this interval, west of Vicolo del Mandrione, within the grounds of the Opera Don Bosco, an agricultural school for boys, is a large rectangular cistern. It was drawn by Antonio da Sangallo,² who notes that it was near the aqueducts and a mile (really more) outside Porta Maggiore. It measures 29.26 by 24 m. inside, and has thick walls faced with semicircular niches and projecting buttresses between them, so as to resist the pressure of the great mass of water which it contained. The construction, perhaps of Hadrianic date, is of *opus reticulatum* with brick bands, small blocks of tufa being also used at the internal angles. The cement floor, as often, rests on herring-bone brickwork. Its level is too low for any of the aqueducts, and it is a supply-tank, not a clearing cistern. A channel through the wall, 0.30 by 0.37 m. and 1.45 m. above the floor, served for the overflow. An inlet, 0.27 m. wide and 0.27 m. from the floor, has been blocked.

The next relic of the aqueduct is a pier of original construction, enclosed in the south-east end of a house near *caposaldo* 13, marked in the map as 52 m. above sea-level; from which the bottom³ of the *specus* may be computed at about 57.67 m. The aqueduct at this point has made a right-angled turn, and is running north-east before resuming its normal north-west direction. This is shown by the grooved ends of the three courses of grey-brown tufa blocks above the upper *peperino* string-course, which belong to the sides of the *specus*. Below this string-course there are seven courses of tufa blocks, a string-course of *peperino*, and three courses which form part of the foundation; the two lowest are of grey-yellow tufa, weathered much worse than the rest, and may have been buried below ground.⁴ The width of the pier is 0.96 m. above the lower string-course, of four blocks 0.31 m. high, and 2.40 m. below it. Lanciani describes a further portion of the aqueduct, near the junction of Vicolo del Mandrione and Via Labicana, opposite Vigna Quaranta, consisting of a series of arches, believed by him

¹ 115: 107.

² '*Conserva d'acqua appreso alle forme fuori di porta maggiore uno miglio*,' *Uffizi*, 900 = Bartoli, *op. cit.*, tav. cclxxxii, fig. 467.

³ It is the second piece described by Lanciani, *loc. cit.*

⁴ One of them is 0.55 m. wide, 1.10 m. high; the next course, of red-brown tufa, is 0.65 m. high. Anathyrosis (see Glossary) is distinct in the grey-yellow, and probably in the red-brown. A little late brick reinforcement may be seen upon the south-east side.

to be Severan, at ground-level, composed of two rings of tiles cut wedge-shape.¹ The tile which forms the key he measured as 0.60 m. long, 0.056 m. thick at the bottom, and 0.072 m. at the top. They are still to be seen, but the brickwork looks too good and the joints too close to be Severan: it is classified by Dr. Van Deman as Hadrianic.

Nothing more is visible² until we reach Aurelian's Wall. But a good deal of work, apparently in brick-faced concrete, is shown in Du Pérac's plan of 1577; it is on the east of Via Labicana, whereas Lanciani³ places it on the west.

Cippus 30 must have stood about 366 m. (1,200 feet) from the Porta Maggiore. It was found *iuxta formas . . . ad fauces putei*, according to Cittadini; while the 25th, seen, as the same authority states, *in vinea quae est extra (or contra) portam Maiorem, ad fauces putei* can only have been a little way outside the Gate, since *cippi* 24 *a* and *b* lay well inside it. Just to the east of Porta Maggiore a pier and part of an arch carrying all three *specus* superimposed are preserved by inclusion in Aurelian's Wall (Pl. VIIb).⁴ The top of the travertine slab which supports the cement, about 0.20 m. thick, at the bottom of the Marcia was levelled at 55.77 m.;⁵ that under the Tepula at 57.55 m., and the bottom of the cement base of the Iulia at 59.04 m. above sea-level.⁶ The first three courses of the pier are treated as foundation; the next five, up to the impost, are carefully chisel-drafted and bossed. They are of tufa, and might belong to the original construction; but the impost string and *specus* of travertine must belong to the reconstruction by Augustus, and the whole pier probably does so.⁷ Late concrete, resting on

¹ I suppose it is to this that Parker alludes (*Aqueducts*, 119 *bis*) after describing the pier in the gardener's house of the Opera Don Bosco: 'The ground then rises . . . the upper part of the arches of brick as rebuilt by Trajan are then visible by the side of the old road that runs close to the north side of the Claudian arcade.'

² Their level would give to the Marcia, not to the Anio Vetus, four piers of travertine, found on the west of Via Casilina about 200 m. before reaching the Porta Maggiore (Gatti in *Not. Scavi*, 1920, 282). They lay 1.45 m. below the modern road-level and parallel to it; they were 1.40 m. wide on an average, and the intervals between them were respectively 4.10, 2.75, and 3.40 m. But it is very doubtful whether they belong to an aqueduct at all. The intervals are too irregular; and a wall of ashlar was constructed on top of them; they would also appear to have been on the wrong side of the road.

³ See Parker, photos 38, 59 (= *Aqueducts*, pl. xv, 1); Lanciani, *Ruins and Excavations*, p. 55, fig. 23; Platner, *Ancient Rome*, p. 101, fig. 107.

⁴ *Forma Urbis*, sheet 32.

⁵ Lanciani, 101: 313, says 57.718 m. The difference in level of only 1.24 m. between Marcia and Tepula is insufficient. See the next footnote.

⁶ Lanciani, 171: 383, says 63.739, which makes the difference between this and the Marcia no less than 6.021 m. Here there must be an error. According to Fabretti (19: 17, tab. vii; repeated in *Columna Traiana*, 103) the extrados of the *specus* of the Acqua Felice is 6 feet below the floor of Aqua Claudia, and 8 above the floor of the Iulia. Fourteen Roman feet are 4.139 m.; and, as the bottom of the Aqua Iulia was levelled at 59.04, that of the Claudia at the Porta Maggiore should be 63.179, whereas Signor Nosei made it 64.02.

⁷ According to Dr. Van Deman, who reproduces a photograph of mine, which served as the original for the drawing in *Livellazione*, p. 17, fig. 3.

the impost-string, has been carried up on each side of all three *specus*, as at Roma Vecchia.

The aqueduct is cut by Aurelian's Wall, a tower being built upon it, enclosing one arch; and immediately inside the Wall the haunch of an arch can be seen springing from the west end of a stone pier,¹ reinforced in concrete faced with Hadrianic brickwork: lower down, just to the south, there is late brickwork, with traces of cement lining, which may belong to the reservoir noted by Piranesi² as 'having been constructed far later than the aqueducts themselves'. But Piranesi's reservoir is, with far greater probability, to be identified with a piece of late brick-facing, photographed by Parker, immediately north of Aqua Marcia, against the City Wall, with some cement lining upon it.³ Parker appears to have also seen one more pier; for he notes⁴ that 'inside the Wall a part of the first arch remains with the *specus* upon it (60); on the other side of the road, the pier of the same arch remains built in the wall of the garden; and a little farther on in the garden or vineyard, a gardener's house is made out of another reservoir or *castellum aquae*'.

For a distance of some 20 m., going north-westward from the ashlar inside the Wall, a row of concrete piers, 0.90 m. wide and of varying lengths, faced with Augustan *opus reticulatum* quoined in tufa, follows the north-east edge of the line which the vanished Aqua Marcia⁵ must have taken.⁶ At the end of the line is a solid mass of concrete,⁷ which still stands on the edge of the road leading under the railway, south-west of the shaft of Anio Vetus. Into the lower part of that shaft, faced inside with Augustan *opus reticulatum*, leads a small channel 0.45 m. wide, preserved for more than 3 m.; it has a roof of stone slabs, followed, at the entry to the shaft, by a gabled roof of tiles. This channel⁸ must have

¹ See Parker, photograph 60 (= *Aqueducts* pl. xv, 1). It is this piece, and not the Anio Vetus, which is shown by Piranesi, *Antichità romane*, i, pl. x. 1 (supra, p. 81, n. 2).

² *Antichità*, i. 7 no. 128.

³ *Aqueducts* (1876), 119 bis; photograph 967. From its level this is far more likely to have belonged to Aqua Marcia. Photograph 968, to which he refers, shows the exterior of the Aurelian Wall at this point; we may also compare No. 60.

⁴ *Aqueducts* (1876), 119 bis. Cf. photograph 538 and section 700*.

⁵ The angle of wall, shown by Lanciani (*Forma Urbis*, 32), must have belonged to one of its concrete reinforcements.

⁶ They must have been found after 1912-13, for they are not included in the plans attached to the reports of that period. Gatti in *Bull. Com.*, 1912, 228; Ghislanzoni in *Not. Scavi*, 1913, 6.

⁷ Loc. cit., p. 8; described by Ghislanzoni as 'a construction in masonry in the form of a pillar, which I believe was once a *puteus* (because it is entirely similar to the shaft B); it was then filled with concrete'. In his plan it lies to the south-west (not, as he says, the south-east) of C, but is not lettered: in *Bull. Com.* it is not mentioned at all.

⁸ It is wrongly described in *Not. Scavi*, loc. cit., p. 8, as 'an extremely late drain of which a small portion is preserved; the bottom is composed partly of tiles with the edges broken off, partly of small square bricks, and the roof in one part is formed of tiles placed gable-wise, and in the other by a slab of *peperino*'. In *Bull. Com.* it is not mentioned.

served to bring the water of the Marcia into the *specus* of the Anio Vetus.

In 1912-13 three piers¹ of the Aqua Marcia were found, in the same straight line, at a distance of about 30 m. from the last.² They were 5 m. apart, and each measured 2.75 m. long and 2.60 m. wide, like the pier outside Porta Maggiore. On either side of the central pier of the three was a *cippus*,³ numbered 24, with the usual inscription of Augustus. That on the north of the aqueduct was found prone, only a very little way from its original position; that on the south was built into the pier of another aqueduct, believed to be Aqua Claudia.⁴ They are equidistant from the aqueduct, and practically *in situ*. This discovery shows that these and the next group of three piers to the south-west were genuine piers and not buttresses of vanished piers.⁵

The flight of stairs⁶ found to the north-east of the first pier may, or may not, have been connected with the aqueduct; the other constructions⁷ appear to have been *nymphaea* or fountains.

Both Piranesi and Lanciani believe that the aqueduct was now incorporated in the City Wall by Aurelian, although no one recorded anything when the Wall was twice pierced for the railway. Even beyond the railway, Lanciani⁸ shows no trace of aqueducts for a long way, the remains having been completely hidden by Aurelian and the later reconstructors of the Wall,⁹ though the water must have continued to flow.¹⁰ But Parker gives quite a different account:¹¹ 'The arcade of the Aqua Marcia', he states, 'runs across one corner of this ground (Vigna Belardi) from the arch that is visible just inside the Wall of Aurelian close to the Porta Maggiore, passing within a few yards of that arch into the higher ground just beyond. The railway cuts through this small hill and the aqueduct. Part of the stone arcade of the Marcia is

¹ *D* in *Bull. Com.* (see p. 233).

² It is a pity that they are not shown in either of the places in the articles cited above, and that the lettering of these places differs entirely.

³ This pair of *cippi* are said to have been 4.10 m. apart (*distante l'uno dall'altro*, p. 233): but a reference to the plans shows that what is meant is that each of them was 4.10 m. (14 Roman feet) distant from the aqueduct, which is a very different thing, and a fact of considerable importance: for we thus get the normal strip of ground on each side (*supra*, p. 40).

⁴ *d1, d* in *Bull. Com.*, where they are said to have both been found *in situ*; *D, E* in *Not. Scavi*. Cf. *infra*, p. 243.

⁵ Gatti notes that the distance along the line of the aqueduct from the 71st *cippus*, taking the normal interval of 240 feet, would give a distance of 3,337 m.

⁶ *Not. Scavi*, *F* and p. 7; not in *Bull. Com.*

⁷ *G* in *Not. Scavi*; *F* and *G* in *Bull. Com.*

⁸ *Forma Urbis*, 24, 25.

⁹ Lanciani, 90: 302.

¹⁰ The arches (with the brickwork hypothetically removed) are shown in a plate by Piranesi (No. 27 of the *Campus Martius*, in which he refers to *Antichità*, i, pl. vii, nos. 119-21); cf. *Calc. 441a*(= Focillon, 932, who notes it as a tail-piece to p. xxxvi of the treatise entitled *Della Magnificenza ed architettura dei Romani*; see *Burlington Magazine*, xxxiii, 186-90).

¹¹ *Excavations in Rome*, 1870-1, 16.

visible in the first pit to the right from the gate.' And in his later work he writes¹ that Aqua Marcia 'then passes again underground parallel to the city wall for a short distance, and near the Minerva Medica it runs into the bank on which that great wall is carried. A portion of this underground arcade was brought to light in some excavations in 1871, but is now covered up again (2320).' The number refers to his photograph, in which four courses of tufa are shown: while two other photographs (2264, 2321) show an arch in Hadrianic² brickwork, found in the same excavations, but already covered up again in 1876.³

In the fifth tower south of Porta S. Lorenzo, according to Lanciani, Piranesi puts the *castellum* of the *Rivus Herculanus*.⁴ There is a *specus* hereabouts, almost at the present ground-level, but it is not in the fifth tower; it lies at the south end of the back of a house-façade⁵ built into the City Wall. At the back of this house was a reservoir, of which the north-east side only is visible.⁶

From this point, according to Lanciani,⁷ the aqueduct begins to be independent of the City Wall: and seven piers without reinforcement are indicated, followed by eight with more or less considerable strengthening in brick-faced concrete.

Close to the fourth tower from the gate, on the inner side, are remains of a tiny reservoir, and some walling in *opus mixtum*; but Parker shows remains of a much larger structure: 'there are remains', he says, 'of a *castellum aquae* or reservoir for the Tepula, near the Porta Tiburtina . . .'. This, however, is the house⁸ just noted. He then continues: 'between this building and the gate, but within the wall, though on the bank on which it stands, are slight remains of another *castellum aquae*, supposed to have been for the Julia,⁹ which has its external face in the direction of the wall, and must have been concealed by it when that was built. This is also of the first century, as is shown by the brickwork, and it appears to have been a *castellum aquae* by the disproportionate size

¹ *Aqueducts*, loc. cit.

² According to Dr. Van Deman; Parker (text to pl. xvii. 2, in which the first of these photographs is reproduced) dates the work as Trajanic.

³ There is no trace of this in Lanciani, *Forma Urbis*, 24.

⁴ Lanciani, 91 : 303 and 99 : 311; cf. Piranesi, *Antichità*, i, tav. ii, f. 16, no. 17, 121; xi, fig. 1, F; xxxviii, no. 22, and fig. 2 (a detailed representation of it). See *infra*, p. 154.

⁵ This was pointed out by Lanciani to Calza, *Mon. Linc.* xxiii (1916), 575 and pl. v, c. Nibby (*Mura di Roma*, 348) had believed it to be a reservoir. See Richmond, *City Wall of Imp. Rome*, p. 14, fig. 5.

⁶ It must be that described in Lanciani, 91 : 303, as 'inside the walls, about 200 m. before reaching the Porta S. Lorenzo: it is cut by the city walls so that only one side of it is seen'. But the one side visible is precisely that which lies towards the City Wall; the reservoir extended towards the south-west, and this side has been destroyed by the construction of the road on the inner side of the City Wall, itself now abandoned and closed.

⁷ *Forma Urbis*, 24.

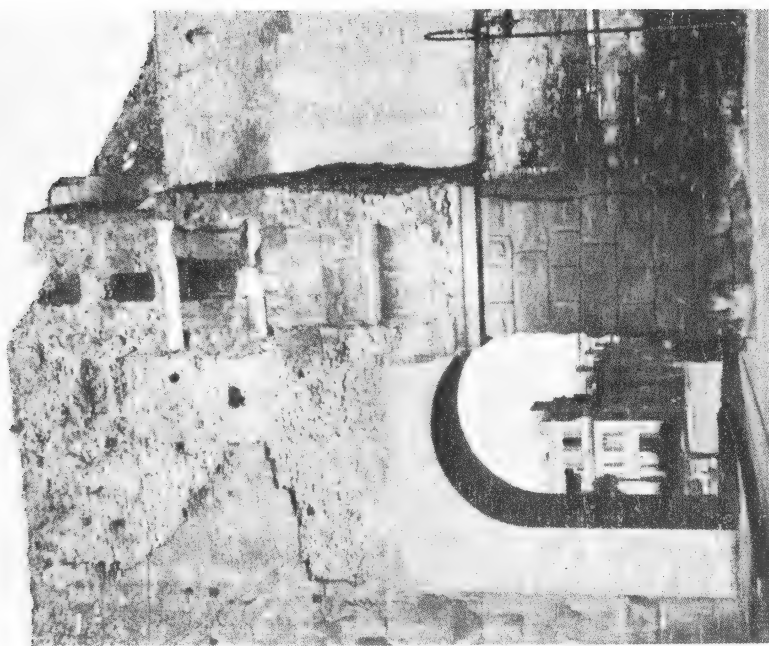
⁸ See nos. 1111* and 1238*, and a view of it in no. 25. See also no. 1874.

⁹ See nos. 26, 869, 1873.

PLATE VII



a. AQUAE MARCIA-TEPULA-IULIA, NEAR PORTA FURBA



b. AQUAE MARCIA-TEPULA-IULIA, AT PORTA
MAGGIORE

of the buttresses used to support the weight of the water.¹ Opposite the seventh of the eight piers shown by Lanciani is a tower—the third from the gate—in which he places *castellum aquae Marciae*.²

There is a modern opening between this and the next tower, and the last pier of Lanciani's group of eight was destroyed in making it. Then follow twelve piers, probably of the Augustan period, to which the travertine imposts certainly belong; they have been strengthened with brick-faced concrete of the period of Hadrian,³ and reinforced later right up to the top of the three *specus*, as at Roma Vecchia. Again, when an arched opening was made in 1880 for the tramway, in the curtain next to the Gate, one of the tufa piers was found: it had been strengthened by a concrete wall of tufa chips, later incorporated in the Wall of Aurelian. Further work was done in 1884,⁴ and the arches were cleared 'for a length of some 200 m.'. The last four piers, between the tramway-arch and the Gate, each measure 2.25 by 1.80 m., with arches having a span of 5.80 m. Just to the east of the Gate the *specus* of the Tepula and Iulia diverge 17 degrees from the line of the Marcia, but soon rejoin it again.⁵ This change is effected so that these smaller and narrower *specus* may have one of their side-walls resting on a wall of the Aqua Marcia.

A fine Arch was built by Augustus, in 5 B.C., over Via Tiburtina (Pl. VIII a), and placed to cross it at right angles.⁶ The single archway is of travertine,⁷ and on the keystone is a bull's head, which gave the name Porta Taurina to the Gate. The rectangular *specus* of the Marcia here measures 1.95 by 0.90 m.; that of the Tepula 0.85 m. to the spring of the vault and 0.25 m. more to the intrados, which has been lowered and widened so as to conform more or less to the lines of the Arch.⁸ The dedicatory inscription of Augustus is on the exterior of the Iulia's *specus*; while Titus and Septimius Severus added theirs⁹ on the exterior of the Tepula and Marcia respectively, trimming off the Augustan cornice and pediment in order to get a smooth surface for them. Lanciani notes¹⁰ 'a lateral opening arranged so as to give air to the different conduits without any loss of water'; it was 0.55 m. wide and lined with cement, but the drawing in his notes¹¹ is unintelligible.

¹ *Aqueducts*, 120 bis, 121 bis.

² *Forma Urbis*, 23.

³ The tile-stamps belong, however, to the Flavian period; *CIL.* xv. 991, a, 1; 1123, 1353; cf. *Not. Scavi*, 1884, 221.

⁴ *Not. Scavi*, cit.

⁵ So Venuti, cit.; Lanciani, 91 : 303; *Sched. Vat.* 37, f. 61.

⁶ For *cippus* 18, attributable to the Anio Vetus, see p. 83.

⁷ Among the numerous illustrations we may cite: San Gallo, *Barb. Lat.* 4424, ff. 26, 27; Fabretti, 45 : 36, and pl. xiii; Piranesi, *Castello dell'Acqua Giulia*, tav. v-viii; *Antichità*, i, tav. x, fig. ii (plan); Canina, *Edifici*, iv, pls. 228-30; D'Espouy, *Fragments*, ii, pls. 63, 64.

⁸ Fabretti, 45 : 36, tav. xiii, E.

⁹ *CIL.* vi. 1244, 1246.

¹⁰ Lanciani, 88 : 300.

¹¹ *Sched. Vat.* 37, f. 62.

Aurelian incorporated this Arch in his Wall, flanking it with two towers and probably adding a portcullis-chamber outside it. Honorius built the inscribed stone curtain and two massive towers encasing those of Aurelian;¹ and an arch in stone, forming a court behind the aqueduct-arch, had already been added. As early as the eighth century it acquired the name of Porta S. Laurentii, because it led to the church of that name.² The removal by Pius IX of the innermost archway, and excavations in 1918, have rendered the remains of the aqueduct more visible than they were in the time of Piranesi.³

From Porta S. Lorenzo to the Arch of the Acqua Felice over Via Marsala (formerly Via di Porta S. Lorenzo), which was erected in 1585, there are thirteen piers of tufa ashlar which may belong to the original construction.⁴ The whole stretch⁵ has been reinforced and masked by brick-faced concrete, with buttresses 2.05 m. wide, 5.03 m. apart,⁶ placed against the piers, all attributable to the restoration of Caracalla.

From the point where the Acqua Felice leaves it, the aqueduct is shown as fairly well preserved in Bufalini's and Du Pérac's plans, but has been more ruined of later years. Lanciani shows only two piers preserved out of eighteen in the Giardino Gentile and Vigna Polidoro, followed by four masonry piers with five arches, filled with later concrete.⁷ From this point he marks, following Nolli, a line of twenty piers, now obliterated by the artillery workshops: and then the aqueduct began to run underground. A travertine *cippus* numbered 3, perhaps belonging to it, was found in making the foundations of the artillery workshops at the corner of Via Marsala and Castro Pretorio. It bore the fragmentary inscription . . . AVGVST. EX S.C. III PED(es) CCCL XI, XI being added in another hand, and the L perhaps also altered. It is supposed to have been found *in situ*; but the position disagrees with that of *cippi* 5 and 2 of the Marcia; while its number is too low for the Anio Vetus. Hülsen, therefore, prefers to place it among those of uncertain attribution.⁸ This is probably correct, for *cippus* 5, seen complete in the seventeenth century,⁹ was redis-

¹ Richmond, *City Wall of Imperial Rome*, pp. 170-81, fig. 33.

² Platner and Ashby, *Topographical Dictionary of Ancient Rome*, 417, 568. The other name, Porta Taurina, derived from the *bucranium* on the key-stone of the aqueduct-arch, occurs in *Graphia aureae Urbis Romae*.

³ See, for example, the description given by Venuti, *Antichità di Roma* (1824), i. 195.

⁴ The span of the tufa arch at a modern garage is 5.27 m.

⁵ Lanciani (*Forma Urbis*, 18, 24) shows the first five piers (6 arches) free of reinforcement: this is true only of the first pier.

⁶ They are later increased to 2.57 m. with a corresponding decrease in the interval between them. Lanciani, 91: 303, gives the measurements as 1.28 m. wide and 4.90 m. apart. Cf. Piranesi, *Antichità*, i. 16, n. 117, and pl. xi. i.

⁷ For the *cippus* 13, attributable to the *Anio Vetus*, see *supra*, p. 83.

⁸ *CIL.* vi. 31568; cf. Lanciani, *Bull. Com.*, 1885, p. 101, no. 1022. ⁹ *CIL.* vi. 31561 b.

covered only just across the road from this one in 1886;¹ and its position, if measured in normal units from *cippus* 24, is approximately correct.²

The separation of the three *specus* had taken place before *cippus* 5 was reached; for immediately beyond it, between Via Castro Pretorio and Via Milazzo, all were disclosed for nearly 80 m., running in such directions that it is clear that they must have diverged at least 20 or 30 m. farther back. They then crossed one another, and, retaining their previous directions, ran separate once more.³ The *specus* of the Marcia was built of blocks of *peperino* and *sperone*, 0.26 m. high, 0.47 m. long, lined with strong cement: its internal dimensions were 1.50 m. high, and 0.70 m. wide; the roof was formed of slabs 1.70 m. wide laid horizontally for a length of 9.87 m.,⁴ and gabled for the rest, the gable adding 0.50 m. to the height. A *puteus* was found at its south-east extremity.⁵ Where horizontal slabs were used, they served to floor the *specus* of the Tepula, being thus used for a length of 8.07 m.: this *specus*, 0.48 m. wide, measured 0.90 m. high, excluding an elliptical vault with a chord of 0.17 m., with walls 0.50 m. thick. It was lined within and faced without with hydraulic cement. The *specus* of the Iulia, which was in concrete faced with fine *opus reticulatum*, had similar measurements. The levels of the bottom of the *specus* were respectively 52.57, 54.37, and 55.90 m. above sea-level. At Porta S. Lorenzo the bottom of the Marcia was at 54.146 m., giving a fall of 1.576 in about 690 m.⁶

The *specus* of Aqua Iulia was found in 1879 near the corner of Via di Porta S. Lorenzo (now Via Marsala) and Via Vicenza,⁷ for a length of 27 m. The intrados lay only 0.80 m. below the level of the church of the Sacro Cuore: the *specus* was 1.60 m. high and 0.46 m. wide, with a concrete bottom. The walls were 0.34 m. thick. This *specus* was running parallel to the *Agger* of the Republican Wall in a north-westerly direction; but, like the Anio Vetus, all three aqueducts must very soon have turned to pass under it at right angles, and they appear, very naturally, to have done so at the Porta Viminalis, so as to be able to cross the ditch on the causeway carrying the road from the Gate. The vaulted *specus* of an aqueduct, in *opus reticulatum*, was seen immediately to the north of the Gate⁸ at ground-level, and believed by Lanciani, no doubt

¹ Gatti, *Bull. Com.*, 1886, p. 149, no. 1192, *Forma Urbis*, 18.

² 19 by 240 feet = 19 by 71.31 m. = 1,357.89 m.

³ Lanciani, 92 : 304 and pl. vi, figs. 4, a-c; cf. *Forma Urbis*, 18.

⁴ *Sched. Vat.* 37, f. 74.

⁵ At F in Lanciani, pl. vi, fig. 4 b.

⁶ We have already seen (p. 83, n. 9) that the distance from *puteus* F to *cippus* 13 of the Anio Vetus is not 569 m., as given by Lanciani, but about 450 m.

⁷ *Forma Urbis*, 17; in Lanciani, 92 : 304 and Pl. vi 5 a, b, Via Castro Pretorio is given, but wrongly.

⁸ There is some doubt as to the exact point, but I follow the representation in *Forma*

rightly, to be that of the Iulia: for, inside a small concrete chamber faced with second-century brickwork, a little to the east of the Gate, the second *cippus* was found;¹ and, below the chamber, the actual turn of the aqueduct, from due W. to WSW., appears to have been visible. From the fifth to the second *cippus* Lanciani reckons 210.20 m., which corresponds closely to six *actus* (213.93);² but the distance on the *Forma Urbis* is not less than 345 m., and the intervals must therefore necessarily have been abnormal. Actually, the interval indicated on the front of the second *cippus* is 425³ feet; but a piece detached from the back bore the number 402. The reason of this unusually large interval is perhaps, as Lanciani suggests, the desire to avoid placing a *cippus* on the *Agger*; but the *Forma Urbis* shows that a distance of only 65 m. takes us clear of the *Agger*, to the point where, after having passed under the Wall and *Agger*, the *specus* of the three aqueducts turn at right angles, and follow the line of the Wall towards the south-east, precisely as the Anio Vetus does. Just before the turn,⁴ a *cippus* of Didius Gallus and his colleagues (between A.D. 39 and 49) was found *in situ*, at right angles to the Wall on the edge of the road leading to the Gate, with the following inscription:⁵ HAC RIVI AQVAR|(um) TRIVM EVNT CIPPI | POSITI IVSSV | A. DIDI GALLI | T. RVBRI NEPOTIS | M. CORNELI FIRMI | CVRATOR(um) AQVAR(um).

One hundred and ten metres beyond the turn, in January, 1869, there was found under the Monte della Giustizia⁶ a pair of similar *cippi* also *in situ*.⁷ The inscriptions faced south, at right angles to the *Agger*. The *cippi* were both 2.20 m. high, 0.65 m. wide, and 0.53 m. thick. The space between them was 1.17 m., or four Roman feet.⁸ Unfortunately, the *specus* which must have run below ground at this point were not sought.

The Marcia is shown, perhaps hypothetically, to continue for another 20 m. south of these *cippi*; then it appears to end, and no further trace has been found. It probably kept to the high ground

Urbis, 17, rather than the incomplete plan in *Bull. Com.* 1876, pl. xviii, and the description in the text; and in *Lanciani*, 93 : 305 'under the threshold of this gate we see at the ground-level the vault of the *specus* of an aqueduct in *reticulatum*, which everything makes us believe to be the Iulia. It crosses the gate diagonally, and is certainly later than it, because the blocks of peperino which form the floor of the gate have been cut to open a passage for it.'

¹ It was in travertine, and measured 0.80 m. high, 0.50 m. wide, 0.20 m. thick.

² 240 feet = 71.31 m.

³ Not 430, as Lanciani thought; see *CIL.* ad loc. The back is not now visible.

⁴ *Lanciani*, 94 : 306, expresses considerable doubt as to whether a small reservoir (*Bull. Com.*, 1876, 135 and pls. xviii-xx), which was found close by, was really a *castellum* of the great aqueducts.

⁵ *CIL.* vi. 31559 c; *Not. Scavi*, 1876, 88.

⁶ The site is under the north-east portion of the original railway station.

⁷ *CIL.* vi. 31559 a, b; Visconti in *Bull. d. Inst.*, 1869, 213. A photograph of the *cippi* was taken at the time, of which two copies may be seen in Lanciani, *Sched. Vat.* 37.

⁸ In the further calculations 1.60 is a mistake for 2.47, i.e. 1.17 + (2 × 0.65).

as much as possible, like the Anio Vetus, whose course it had been exactly following. The situation of the terminal *castellum* is difficult to fix. Four hundred and twenty-five feet from *cippus* 2 takes us to *cippus* 1, after which a normal interval of 240 feet marks the termination of the *specus* as marked by Lanciani. But there is no trace nor indication of any *castellum* in any direction.¹ Thus, either the original *castellum* was replaced by one elsewhere, or the *cippi* were not, under the Empire, 'any longer in close connexion with the terminal sector of the three aqueducts and their *castellum*'.

(g) *Branches in the City near Porta Viminalis.*

Some water from Aqua Marcia was certainly distributed in lead pipes from the Porta Viminalis itself, for a considerable number of them have been found in the neighbourhood. Martial, whose house was on the Quirinal,² may have received his supply from a main which issued hence. But the actual starting-point of these pipes has not been found. The only relic of any distributing-system hereabouts is a small circular tower, constructed of tufa and travertine, on the south-east edge of the road just outside Porta Viminalis. Lead pipes³ issued from two holes on its north side; but the structure is not traversed by a *specus* at their level, which could only have been reached by a siphon. Water could only have been drawn in the tower by means of buckets. On the north side there is a small door with uprights and lintel and threshold of travertine: the hole for the wooden doorpost may still be seen. The whole building⁴ is covered, inside and out, with very hard deposit, so thick inside as to block the shaft. It is still to be seen in the railway yard, south of the remains of Porta Viminalis. Its object and history have been so little understood that it has recently been called a small Republican tomb.⁵

The course of the Iulia is a difficult question. Lanciani⁶ observes that some considerable part of the Marcia, Tepula, and

¹ Lanciani, 94 : 306.

² ix. 18.6: see below, p. 152, for a fuller discussion.

³ Lanciani, 95 : 307, pl. vi. 2. In his text Lanciani refers to *Sylloge*, 105 f.: but the only pipe that really corresponds to the description is 105 itself, inasmuch as it was found in 1878, whereas the tower had not come to light as early as 1876, when other pipes (108, 113, 115, 123, 124) were found. Even so, the internal diameter of 105 is said to have been reduced by deposit from 0.40 to 0.15 m. 'which shows that the water it conveyed was that of the Anio Novus'. In *Not. Scavi*, 1878, 92, the pipes are spoken of as 'numerous' but are not specified; while *ibid.* 132, *Syll.* 134, 135 are recorded as having been found in 1877. Cf. *CIL.* xv.

⁴ *Not. Scavi*, cit. The measurements are: external diameter 3.00 m.; size of circular stone on top 1.75 m.; window on north 0.65 m. wide, 1.10 m. high.

⁵ Von Gerkan, *Gnomon*, i (1925) 245. Editor's note: granted the pipes, a pumping-chamber seems an easier explanation of the structure than a well-house. Cf. Vitruv. x, 7.

⁶ Lanciani, 95 : 307.

Iulia turned south from Porta Viminalis towards Porta Esquilina; as 'is proved, not only by the discovery of the two terminal *cippi* of Didius Gallus at a considerable distance south-west of Porta Viminalis, but, in a much more material form, by the discovery of the highest of the *specus*, that is of the Tepula [*sic*], in cutting the Via Principe Umberto and the Via Napoleone III. I have already published the drawings¹ and I repeat them now'.² But in his general plan of Rome³ an aqueduct is marked, not west of the Anio Vetus (as in these drawings) but on the east, between it and the *Agger*; nor at either point mentioned, but for a length of about 75 m. between them, in which is included the Piazza Manfredo Fanti.⁴ This would be, in any case, a subsidiary *specus*, for it lies beyond the terminal *castellum*, at which the numbered *cippi* ended. A *puteus*, probably belonging to it, is recorded by Lanciani⁵ as lying between the Via Napoleone III, the Via Rattazzi (Via Mazzini, now Cattaneo), and the Piazza Fanti. It was circular, 1.05 m. in diameter, with foot-holes; and the sides were 0.40 m. thick. It led into a *specus* 0.85 m. below the street level, with a vault 0.50 m. thick and walls 0.40 m. thick, which measured 1.70 m. high to the intrados of the round vault, and 0.52 m. wide, all of very bad construction. The level shows that it cannot belong to the Anio Vetus, a *puteus* of which, in the Via Napoleone III, was computed at 9.00 m. deep. From the south side of Piazza Manfredo Fanti the aqueduct crossed the former Via Mazzini, now Via Cattaneo, at a very slight angle, taking most of the distance between Via Principe Amedeo and Via Napoleone III in doing so. An interesting drawing of it is given in Lanciani's notes.⁶ The blocks of stone forming its sides were 0.52 m. thick on one side and 0.65 m. on the other, and the width of the *specus* was 0.65 m. The gable roof was formed of two slabs of stone, with concrete packed outside them.⁷ This was thought to be the Anio Vetus. But the level of Via Napoleone III, given as 54.89 m., shows the impossibility of this aqueduct being the Anio Vetus, as its intrados is only 1.05 m. lower.⁸ Again, its construction is unlike that of the Iulia or Tepula. There is, indeed, no other record of the Marcia here, but both the level and construction suit it best.

¹ *Bull. Com.*, 1874, 200, where there is no word about the Tepula.

² *Lanciani*, pl. iv. 8, 9.

³ *Forma Urbis*, 17, 23.

⁴ The upper *specus* (E) shown there might belong to it, barring a difficulty about the level. See *Lanciani*, pl. iv, 1.

⁵ It is not shown in the *Forma Urbis*. It was found on 15 March, 1880, too late therefore to be mentioned in Lanciani's definitive work, *Sched. Vat.* 37, f. 16.

⁶ *Sched. Vat.*, 37, f. 19.

⁷ Directly above was another *specus*, 0.55 m. wide, only preserved for a height of 0.85 m., at which it was cut by the modern street.

⁸ Cf. p. 86, where the A.V. is 9.00 m. below ground.

(h) *The Branch towards the Baths of Diocletian.*

Another branch of the three aqueducts went north-west from inside the Porta Viminalis. The Iulia ran nearest to the *Agger*¹ and was lined with brickwork: the Tepula and its *putei* were lined with *opus reticulatum*:² a third *specus* was found at a higher level, running above ground along the road which followed the north-east side of the *Thermae Diocletianae*. Lanciani believed the last to be contemporary with the Baths³ or to have been reconstructed when they were built; it was protected by a thick layer of hydraulic cement, painted red, with holes in the vault at frequent intervals; it measured 1.47 by 0.68 m. internally. All three *specus* were running towards the site now occupied by the Finance Ministry, in excavating for which traces of three reservoirs were found. Only one was at all well preserved: it was divided into rectangular chambers, with external walls 2 m. thick at the base, and 1.30 m. at the top, the largest being 51.60 by 29.80 m. and subdivided into five long chambers by buttressed walls. Remains of another were thought to have been found to the south, consisting of five more parallel chambers, apparently reconstructed, but found much destroyed. A third, better preserved, with three parallel chambers, was found still farther south.⁴

Lanciani is perhaps right in associating each reservoir with one aqueduct, and was certainly right in maintaining that the terminal *castella* of these aqueducts lay hereabouts by the time of Frontinus, who states that 'flowing underground they reach the level of the Viminal Hill, and in fact even of the Viminal Gate, where they again emerge'.⁵ It is not impossible, though entirely a matter of conjecture, that Diocletian destroyed the original reservoirs, and made these particular ones when he constructed the large trapezoidal reservoir which served exclusively for his *thermae*. This was the famous *Botte di Termini*, finally destroyed only in 1876.⁶ It was 91 m. in length, with an average width of 16 m. Finally, Lanciani⁷ attributes to this branch a late fourth-century

¹ *Bull. Com.*, 1876, 138, pl. iii; *Lanciani*, 95: 307; *Forma Urbis*, 10.

² One of them is probably that mentioned in *Not. Scavi*, 1878, 131: 'nella piazzetta del Macao, sulla linea del prolungamento di Via Gaeta . . . è stato scoperto lo spiraglio di un pozzo di opera reticulata, chiuso da un lastrone di travertino con foro circolare nel centro.'

³ In fact he marks it *ductus aquae Ioviae*, see *Forma Urbis*, 10.

⁴ *Bull. Com.*, 1876, 138; Rosa, *Relazione*, 38-40; Canevari in *Mem. Linc.* ii. 417 ff. and pl. iv; *Lanciani*, 95: 307.

⁵ *Frontinus*, 19; the text is corrupt; *quae ad libram (collis Vi)minalis con . . . ntea (flu)entes ad Viminalem usque portam deveniunt. ibi rursus emergunt*; see Herschel, op. cit., fol. v.

⁶ Ligorio, *Bodl.* 81 (*Archaeologia*, li. 502, fig. 12; *JRS.*, 1919, 190); Falda, *Giardini*, 14, No. 23; Ficoroni, *Vestigia*, 124; *Bull. Com.*, 1872-3, 220; 1876, 139; 1906, 106-7; Hülsen-Jordan, *Top.* 13, 382, n. 22; *Lanciani*, 96-106: 308-18.

⁷ *Lanciani*, 177: 389.

inscription copied by Fabretti¹, who states that it was 'effossa ad aggerem Servii': it runs, *arcus pilas et pluteum ex utraq(ue) parte ovata . . . labore expenso a v(iris) c(larissimis) et spectabilibus Tarpeio Anneio Fausto v(iro) c(larissimo) comite ordinis primi et formarum et Iulio Felice Campaniano v(iro) c(larissimo) ex comite ordinis primi et formarum instauratum*.² The meaning of *ovata* is not clear.

(i) *The Branch to the Capitol.*

That water was brought to the Capitol by Marcius himself in 140 B.C., against the advice of the Sibyl, is known from both Frontinus and Livy.³ According to Livy, the Anio Vetus was also brought there. Both were probably small supplies, brought by a siphon: the water certainly did not cross the depression between the Capitol and the Quirinal on arches, or something would have been revealed in literature or on the ground; and, after the time of Trajan, it can hardly have gone beyond his Forum. An underground channel, attributed to this branch, has been noted in Piazza Termini: and a small portion of a conduit found in front of Palazzo Rospigliosi has also been assigned to it.⁴ Both ascriptions are very doubtful.

(j) *The Branch to the Quirinal.*

The Aqua Marcia still ran to the Quirinal in the time of Martial; for we have the poet's petition for a supply to his house on that hill, couched in the following terms:⁵ 'I have—and I pray I may have it long, Caesar, beneath thy guardianship—a tiny country house; and I have, too, a small dwelling in the city. But my curved pole and bucket lift with labour from a shallow valley water to bestow on the thirsty garden; the arid house complains that it is freshened by no moisture, though Marcia babbles in my ears with neighbouring fount.⁶ The water thou shalt give, Augustus, to my household gods will be to me a spring of Castal, or a shower of Jove.' The interpretation of this epigram is by referring

¹ *Inscr.* 677, 31.

² *CIL.* vi. 1765; cf. 31925, where it is pointed out that a squeeze taken about 1700 has recently come to light, which confirms Fabretti's reading. Julius Felix Campanianus appears as *praefectus urbi* on the inscription of a base of a statue which he set up in the *Thermae of Trajan* (*ibid.* 1670). The precise date of these inscriptions is uncertain (see *Bull. Com.*, 1901, 212, no. 35).

³ *Epit. Oxyrhync.*, 188–90: *aqua Anio, aqua (Marcia in Cap)itolium contra Sibyllae carmina perductae*.

⁴ Lanciani, *Forma Urbis*, 16.

⁵ ix. 18. I quote Ker's translation in the Loeb Series.

⁶ Cf. viii. 67, 8. *Caldam poscis aquam: nondum mihi frigida venit*. Martial seems to have been exceptionally unfortunate: cf. Horat. *Ep.* i. 10. 20 *purior* (than in the country) *in vicis aqua tendit rumpere plumbum?* and Strabo, v. 3.

the pole and bucket to the country house, near Nomentum, on the border of Ficulea,¹ and the *fons* to the town house, on the west slope of the Quirinal.² The request is a double one. We cannot suppose that Martial expected to get a supply from Aqua Marcia at Nomentum, but he hoped for something. On the Quirinal, the *vicinus fons* would have been a street-fountain near the house, supplied by a main whence a supply could easily be drawn.

The *forma Lateranensis*³ mentioned on the Quirinal by the Einsiedeln Itinerary is very obscure. Elsewhere in that work, *Forma Lateranensis* means the Arcus Neroniani of the Aqua Claudia; but it seems impossible that any branch of this aqueduct can have been brought as far as the Quirinal, and both Lanciani⁴ and Hülsen⁵ regard it as a mystery. The writer prefers to suppose that the phrase, like *Forma Claudiana*, applied to the branch of the Anio Novus which ran to the Trofei di Mario, is a blunder, but meant a real aqueduct, now vanished.

(k) *The Branches to the Caelian and Aventine.*

It remains to deal with the important branches to the Caelian, of which Frontinus⁶ has much to say.

‘A part of the Iulia is drawn off near Spes Vetus and distributed to the cisterns of the Caelian Hill. But the Marcia delivers part of its waters behind the gardens of Pallas into the channel called *Herculaneus*. This is carried by the Caelian, but affords no service to that hill on account of its low level, ending above⁷ Porta Capena.’

‘The Caelian and Aventine, before the Claudia was introduced, used the Marcia and Iulia. But after the Emperor Nero carried the Claudia, which he drew off on arches near Spes Vetus, to the temple of the deified Claudius, in order to distribute it from there, the first-named waters were not augmented, but fell out of use: for he did not add new reservoirs, but used those that already existed, and they kept their old names, though the water was different.’⁸

‘Now several aqueducts have been restored to them, and above all the Marcia, which is carried on a substantial structure from Spes Vetus to the Aventine.’⁹

These passages show that the Marcia ran to the Caelian in two conduits, at low and high levels. The low-level *rivus Herculaneus*¹⁰ diverged from the main channel behind the gardens of Pallas; and, as the terminal *castellum* of Aquae Claudia and Anio Novus,¹¹ and the point at which the Aqua Iulia received

¹ Martial vi. 67; PBSR. iii. 62, 69.

³ Eins, 2. 6, S. *Susanna et aqua de forma Lateranens(e)*.

⁵ Diss. Acc. Pont. 2. ix. 403.

⁷ *supra* does not mean ‘beyond’.

¹⁰ Plin. N.H. xxxi. 42, wrongly associates it with Aqua Virgo.

¹¹ Frontinus, 20.

² Hülsen, *Top.* i³. 427.

⁴ Mon. linc. i. 459.

⁶ Frontinus, 19.

⁹ Ibid. 87.

⁸ Ibid. 76, cf. *ibid.* 20.

162 *quinariae* from the Aqua Claudia,¹ were alike *post hortos Pallantianos*, these gardens must have lain near the middle of the triangle formed by Viae Tiburtina Vetus, Praenestina-Labicana, and the Aqua Marcia itself: in other words, somewhat south of Piazza Vittorio Emanuele.²

The *castellum* at which the *rivus Herculanus* diverged is believed to be incorporated in Aurelian's Wall, in the fifth tower south of the Porta S. Lorenzo,³ where *opus reticulatum* of the Augustan period can be seen. Remains of a conduit formed of tufa blocks pierced by a circular orifice have been found at various points,⁴ and are generally taken to have belonged to it. Indeed, no less than three such conduits were found in 1917 at the east end of Villa Wolkonsky, two of them superimposed, as apparently first discovered in 1914.⁵ A longer stretch was found in the Villa in 1888, under the pavement of Via Labicana.⁶ One block measured 1.50 m. long and 0.78 m. wide and thick, and had a bore of 0.32 m. A flange 0.075 m. wide projected about 0.06 m. with a corresponding matrix at the other. The deposit was 0.03 m. thick. Further lengths discovered near the hospital⁷ of S. Giovanni in Laterano and on the Caelian, under the *Arcus Neroniani* near S. Stefano Rotondo, in 1886⁸, allow us to follow the line for nearly two kilometres.

The level of the conduit found in Villa Wolkonsky is given as 2 m. below the pavement of the Via Labicana, which was itself some 3.50 m. below ground-level:⁹ the ground-levels are given as 44.30 m. near the east end of the stretch of aqueduct found, and 41.97 m. near its west end, which would put the aqueduct at 38.80 m. and 36.47 m. There are no data as to the levels in Via di S. Stefano Rotondo. In the discoveries of 1917 the intrados of

¹ *Frontinus*, 69.

² *Bull. Com.*, 1874, 53-5; *Lanciani*, 36 : 248; Hülsen-Jordan, *cit.* 358; Platner and Ashby, *Topographical Dictionary*, s.v. *Horti Pallantiani*.

³ Cf. *supra*, p. 144. The evidence is very doubtful.

⁴ We may perhaps attribute to it a rectangular bronze distributing-box, with lead pipes radiating from it, found in Piazza Vittorio Emanuele, in 1888. Some pipes were inscribed: *Ti. Claudi. Caes(aris) Aug(usti) Ger(manici)*, *CIL.* xv, 7784. *Rendic. Linc.*, 1888, 301; *B.C.*, 1888, 400; 1889, 130; 1914, 199; 1917, 242; *Not. Scavi*, 1888, 59; 1889, 66; 1917, 179; *Rom. Mitt.*, 1889, 235; Narducci, *Fognatura di Roma*, 30; *Forma Urbis*, sheet 31.

⁵ *Bull. Com.*, 1917, 242. See p. 42, n. 15 for similar examples.

⁶ *Sched. Vat.*, 37, f. 86, also describes an example.

⁷ *Not. Scavi*, 1897, 104, blocks 0.75 each way, hole 0.39.

⁸ *Not. Scavi*, 1886, 451; *Bull. Com.*, 1886, 406. Reference must undoubtedly be made to this in Parker's *Recent Excavations in Rome made in 1868* (published by the British Archaeological Society) p. 14: 'One of our excavations was made in a reservoir just outside the gardens of the Sessorium and near the lofty arcade just mentioned. Here we found a cascade *specus* carried on an arch of the time of Nero built for the purpose at a much lower level than the other arches. This cascade fell from the high level of the Anio Novus into an old subterranean *specus*, which we traced along the Caelian arch under the Neronian arches. . . . We have not yet completed what we wish to do here and hope to give a further account of them on a future occasion.'

⁹ *Bull. Com.*, 1888, 396, 400.

the uppermost aqueduct was 3.37 m. below the base of the tomb on the east.

Hülßen inclines to attribute to this conduit a travertine *cippus*¹ found under a house bordering Via Merulana, about 50 m. south of Piazza di S. Giovanni in Laterano, and bearing the inscription MAR(cia)² IMP(erator) CAESAR DIVI F(ilius) AVGVSTVS EX S(enatus) C(onsulto) III P(edes) CCXL. It can hardly have been *in situ*, though the accounts of its discovery are silent on the point; for the distance mentioned does not reach to any site assigned to a terminal *castellum*, even on the high-level branch. Thus, the discovery is not informative. The *rivus Herculanus*, Frontinus states, ended above Porta Capena. Juvenal refers to that Gate as *madida*³ and the Scholiast calls it the *arcus stillans*, a name also found in the Middle Ages, and rightly, despite Marchetti-Longhi's recent article, considered identical. This should mean that its terminal *castellum*, somewhat leaky, was situated over the gate and supplied the low-lying district on each side of the Via Appia.

The high-level branch is usually taken to include the Arch of Dolabella and Silanus, erected in A.D. 10 by the Consuls P. Cornelius Dolabella, and C. Iunius Silanus.⁴ It spans the ancient road along the main ridge of the Caelian, near the church of S. Maria in Dominica, and, although its inscription gives no reason for its erection, the plain utilitarian form of the Arch is usually taken to imply that it supported⁵ the high-level branch of Aqua Marcia,⁶ and probably Aqua Iulia also, before it was used by Nero for the *Arcus Caelemontani*.

Apart from this Arch, nothing is left of the high-level branch, and it looks as if Nero destroyed it to make way for the *arcus Caelemontani*. But it was no doubt prolonged to the Aventine. The levels make it almost impossible to suppose⁷ that it was the *rivus Herculanus* which Trajan carried *amplo opere* from Spes

¹ CIL. vi. 31560.

² There is no doubt that the name of the Marcia occurred alone on this *cippus*.

³ Sat. iii. 11. See note 6 for the reference to Marchetti Longhi.

⁴ CIL. vi. 1384. 'P(ublius) Cornelius P(ubli) f(ilius) Dolabella C(aius) Iunius C(ai) f(ilius) Silanus flamen Martialis co(n)s(ules) ex s(enatus) c(onsulto) faciundum curaverunt idemque probaverunt.' cf. p. 3125 for a withdrawal of the view that these arches could not have belonged to aqueducts, as a result of the criticisms of Lanciani, 101 : 313.

⁵ The *arcus Lentuli et Crispini*, near Porta Trigemina, is commonly thought to have done so also, and its level would suit any branch of the Marcia. But it more probably belongs to Aqua Appia (see p. 54).

⁶ It has recently been suggested that this arch belongs to Aqua Marcia, because that supply ran to the Transtiberine region. The latter assertion has no foundation, cf. Marchetti, *Bull. Com.*, 1914, 113. It is impossible to draw the further conclusion that the Fornix Augusti (CIL. vi. 878), which stood in the fifteenth century near Ponte Rotto, is (Hülßen, *Chiese*, 593) to be identified with the *Arcus stillans* of this or any other aqueduct. Lanciani (*Storia degli Scavi*, iii. 39) wishes to associate with this Arch two pedestals (CIL. vi. 897, 898) to Gaius and to Lucius, dated to 2 or 1 B.C.

⁷ As Lanciani, 100: 312, does; for the work, see Frontinus, 87.

Vetus to the Aventine, nor would these words describe its subterranean conduit, certainly older than Trajan. It is, indeed, difficult to see in exactly what manner of conduit the Marcia was carried so as both to supply the Caelian and also to reach the Aventine. But the facts compel the view that it was the high-level branch. Arches actually existed in the valley of Porta Capena. Relics of them were found by Parker¹ in contact with the Servian Wall in the valley, and retaining the impression of its blocks: they consist of three fragmentary arches in brick-faced concrete, assigned by Dr. Van Deman to Nero, which were built as underpinning to vanished ashlar works. They hardly look as though they would have been sufficiently strong to carry an aqueduct which must have been over 20 m. high.² Of Trajan's *amplum opus* nothing appears to be left; the other visible remains belong to an Augustan cistern, attributable to the Marcia, and to a large cistern (called by Parker *Piscina Publica*) which belongs to the Severan age.

Lanciani indicates³ sixteen arches in the Vigna Coltelli (1643), north-west of S. Balbina. It does not seem that the *specus* which cut the Appia and the *specus Octavianus* at the Viale di Porta S. Paolo can really be identified with any part of this branch, from considerations of level.⁴ It must have crossed the valley between the two Aventines on arches:⁵ for the *specus* was found, in May 1892, in Ospizio Artigianelli (now Giovanni Tata), north-west of S. Prisca and south-west of the Castello dei Cesari, where the ground-level is 44 m., while in front of S. Prisca it is 40.25 m., and 35.00 m. to the south-west of it. Fabretti also says that he saw a portion of the *specus* near S. Prisca—'*rursus e regione templi S. Priscæ subterraneus videtur.*'

(1) *The Branch to the Thermae Antoninianae.*

The point where the branch diverged to the Baths of Caracalla⁶ is not certain, though it may have been near the third mile of the Via Latina. Lanciani⁷ describes an underground cistern which he saw excavated by Parker in 1871⁸ on the left of Via Tuscolana, in

¹ See *Aqueducts*, 9, 120 bis.

² The level is 40 m. above sea-level in the garden to the west of SS. Giovanni e Paolo, and 17.48 m. at the bifurcation of the old Via di S. Gregorio and Via di Porta S. Paolo (*Forma Urbis*, 35). Editor's note: this assumes, perhaps wrongly, that there was no siphon.

³ *Forma Urbis*, 41.

⁴ Fabretti (38 : 32) states that he found it 34 (i.e. xxviii + vi) feet above the Appia; but even that would not be enough.

⁵ Jordan, ii. 382, *arcus Romanus inter Aventinum et Albiston* (= S. Balbina; see *Mirabilia*, Jordan, 10, Urlichs, 9). In the *Graphia aureae U.R.*, Urlichs, 116, it is called *arcus Aventinus*.

⁶ Lanciani, 104 : 316: it is wrongly mentioned as a separate aqueduct (*aqua Antoniniana*) in *Notitia* and *Laterc. Pol. Silv.* 545, for the inscription on the Porta Tiburtina refers to a new spring, see p. 91.

⁷ *Sched. Vat.*, 37, f. 69.

⁸ *Aqueducts*, Diagrams, pl. viii D; Parker's plan shows no inlet to the reservoir.

the last vineyard between Osteria del Pino and the Porta Furba. It lay on a line between the gate of the Osteria and the first arches of Aqua Claudia, and was subterranean, consisting of two chambers, each about 18.00 by 5.00 m., with the usual apertures in a dividing-wall. There were also skylights in the vaults. The facing of the concrete walls was very rough, bricks being used only on each side of the door; and the base of the walls was formed by the natural rock.¹ A *specus* left this reservoir at the end of the western chamber, with a *puteus* at this point, and others farther on. It was large enough to walk along by bending slightly. The level of the bottom of the reservoir was 44.50 m. above the sea;² the Marcia at Porta Furba is rightly placed by Lanciani at 'about 60 m.' above sea: while that of the *specus* on the Arch of Drusus is, he says, 41.40 m.

Half a mile nearer Rome, on the other side of Via Appia Nuova, in quarries behind the Osteria degli Spiriti, walls of *opus reticulatum* work were found in the same year (1871) together with a *specus* lined with good brickwork and covered with a gable roof of tiles. It was followed towards Rome, parallel to the north-east side of Via Latina;³ it lay 43 or 44 m. above sea-level. Then, according to Parker, it passed through another *piscina*.⁴ It appears to have been previously recognized both by Fabretti⁵ and Nibby.⁶ The latter, indeed, speaks of 'substructures of it on the left of the Via Latina, a little more than half a mile before reaching the Porta Latina, not far from the Via Latina, and near an ancient branch road' (Vicolo della Caffarella) 'which descends from it to the valley of the Almo. These substructures⁷ are lost at the bifurcation of these two roads, turning to the left in a vineyard: then, turning towards the Via delle Mura, between Porta Latina and Porta Appia, . . . instead of running on substructures it runs on arches, which are cut where they cross the road, but may be seen under the walls of Rome, and there the *specus* can still be traced though it is walled up.'⁸

Outside the City Wall, on the east edge of Via delle Mura,

¹ What the reservoir shown in Parker, *Aqueducts, Diagrams*, pl. vi, may be, is not clear.

² Parker, *op. cit.* 17, note O.

³ Parker, *op. cit.* 18, *Diagrams*, viii.c. = *Historical Photographs* 548, 687, 688, 2106: also *PBSR.* iv. 14, 15, 34, 52.

⁴ See the map at the end of his *Aqueducts*.

⁵ 35; *Diss.* I, tab. i, p. 30.

⁶ *Roma Antica*, i. 341. Whether, as Lanciani and Nibby (*Analisi*, i. 412) thought, *formellus* and *forma* in various medieval documents refer to this aqueduct is very doubtful, see Tomassetti, *Campagna Romana*, ii. 39 (who refers to it, however, as Aqua Appia).

⁷ Fabretti calculates their length at 450 paces.

⁸ This would appear, on considerations of level, to be irreconcilable with Parker's statement that he saw the *specus* in the deep railway-cutting near the bridge under Via Latina. In *Bull. Com.*, 1861, 71, it was described as 1 m. high and 0.61 m. wide. Lanciani could not see it, owing to undergrowth, and the writer has been no more fortunate.

there is a fragment of a pier,¹ where the Wall makes a sharp turn; and inside the Wall, east of Via Appia, a group of arches is indicated in the plan of Rome of Antonio Tempesta (1593), which are not shown by Du Pérac, nor by any authority cited by Lanciani. The so-called Arco di Druso, in the writer's opinion, was erected for and is contemporary with this aqueduct. The *specus* on the arch, according to Lanciani, measures 0.65 m. high up to the impost of the vault, which is 0.39 m. high and 0.82 m. wide, the walls being 0.91 m. thick. When the piazza was enlarged, remains of the arches of the aqueduct were discovered on each side of it.

To the west of Via Appia remains of the aqueduct in Vigna Casali were destroyed by Niccolò Baglioni about 1748.² The aqueduct may have been followed by a road. Remains of eleven arches in Vigna Cavalieri are shown crossing a slight depression in Nolli's plan³, whence Lanciani took the indication, for nothing is now to be seen. Otherwise the channel ran on substructures until it reached the reservoir south-west of the *Thermae*,⁴ a huge erection with thirty-two chambers in two stories, in a moderately good state of preservation. The deposit, Lanciani maintains, is like that of the Marcia, and not that of the Anio Novus.

The supply of the Aqua Marcia in general, and not of this branch alone, was increased by Diocletian, from whom the aqueduct took the name Iovia, widely used in early medieval sources discussed above.⁵

¹ Fabretti, 22, 23; Nibby, *Roma Antica*, i. 341; *Forma Urbis*, 46; Parker, *Historical Photographs*, 883, 884.

² Nolli, *Pianta di Roma*; Piranesi, *Antichità*, i. 7, 42; Venuti, *Roma*, ii. 1; Canina, *Indicazione*, 65.

³ No. 1063.

⁴ *Forma Urbis*, sheet 41.

⁵ See p. 91.

IV. AQUA TEPULA

FRONTINUS gives the following account of Aqua Tepula: 'The censors of A.U.C. 627, Gnaeus Servilius Caepio and Lucius Cassius Longinus Ravilla, in the consulate of Marcus Plautius Hypsaeus and Marcus Fulvius Flaccus (125 B.C.)¹ had the water called Tepula brought to Rome and to the Capitol from the estate of Lucullus, which some hold to be Tusculan territory. The source of the Tepula is two miles to the right along a branch road of Via Latina, at the tenth milestone, going out of Rome. Hence it was conducted in its own channel to the City.'²

'Tepula is credited in the Records with 400 *quinariae*. This aqueduct has no spring: it consisted only of some veins of water which are caught in the channel of Aqua Iulia.³ Its beginning is therefore to be reckoned from the reservoir of the Iulia. It first receives 190 *quinariae* from this; then immediately thereafter 92 from Marcia, and a further 163 from New Anio at the Epaphroditian Gardens. This makes in all 445 *quinariae*;⁴ more than the Records show by 45 *quinariae*, but appearing in the delivery.'⁵

THE source of the Aqua Tepula has been identified, no doubt rightly, with the Sorgente Preziosa.⁶ But the first to perceive this was in fact Holste,⁷ who visited it on 16 October 1649, and saw that it agreed with the distance as given by Frontinus. His account may be translated as follows:

'I inspected the source of the Tepula, now commonly called "la Pretiosa". It is in the Valle Marciana below the ruined castle of Borghetto on the Via Latina at the twelfth milestone: in this valley near the Crabra' (as he wrongly calls the Marrana Mariana) 'there is a forge, and about 300 paces beyond it a most abundant spring gushes forth, generally known as "la Pretiosa", which, from what Frontinus says, is most certainly the Tepula, for it is two miles from the tenth milestone (Le Murene)⁸ if you turn off to the right. But as Frontinus says that the Tepula has no special head but is collected from small rivulets, I think that these rivulets, after they had entered the channel of the Iulia and had ceased to flow into Rome, broke out together in this spring. Frontinus' statement that the intake of the Tepula is in the estate of Lucullus

¹ Plin., *N.H.* xxxvi. 121, wrongly says that it was repaired by Q. Marcius Rex.

² Frontinus, 8.

³ Cf. id. 9, 19.

⁴ Equivalent to 18,467 cubic metres in 24 hours.

⁵ Id. 68.

⁶ Lanciani, 82: 294; *PBSR.* v. 221 ff.; Tomassetti, *Campagna Romana*, iv. 156, 283, 284; a photograph is given by Lais, op. cit. 36. It is marked in our map some 2 kilometres west of Grottaferrata: it must be about 190 m. above sea-level.

⁷ For notes, a plan, and views of the spring, &c., see *Cod. Barb. Lat.* 9898. 21. They are no doubt from a local informant, for Holste does not adopt all the views expressed.

⁸ The reference is, not to Casal Morena, which is lower down, on the right of the road, at the ninth mile, but to the present Villa Senni, which is actually at the tenth mile. It was only later on in the century that it acquired the name Ciampino from Monsignor Ciampini (Tomassetti, op. cit. iv. 166).

suits this spring extremely well. For very extensive ruins of the villa exist below Borghetto on the left of the Via Latina, where I have examined its substructures, which now extend through several vineyards.¹ From these remains of the Villa of Lucullus the spring called Pretiosa is about 700 paces distant,² though I think the property of Lucullus extended much farther over the level ground below, as far as the bridge over the Aqua Crabra below Decimo where immense remains of the Villa, now called "il Centrone", are seen.'

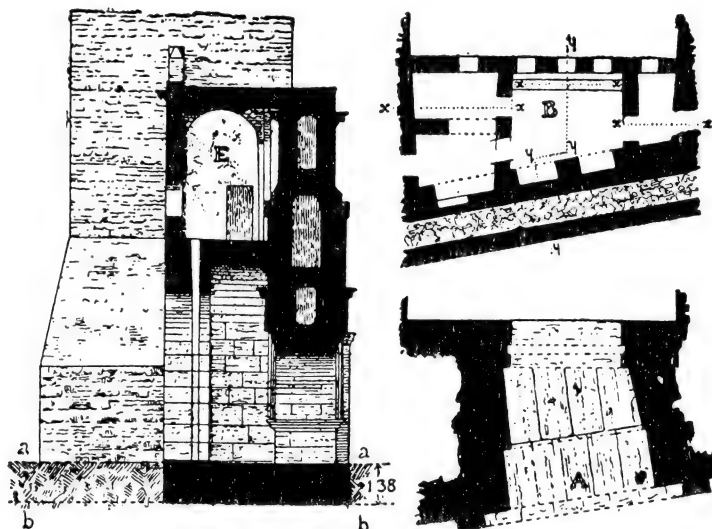
Secchi's identification³ was apparently made quite independently. The temperature of the spring, which has been observed to be 61°–63° F. in winter, when that of the air was 47°, and that of the Aqua Iulia 50°–52°, would alone have sufficed as a clue to its identification.

No part of the first portion of the channel has ever been identified: indeed, from the time of Agrippa, the aqueduct, though running in a channel of its own, had no independent existence. Its springs were tapped by Aqua Iulia, which must here have run close enough and low enough to be able to receive them. The sixth milestone of Via Latina, where lay the reservoir of Aqua Iulia, was just at the point where the branch-aqueduct to Sette Bassi crossed the road. About 500 m. south of this spot, 300 m. north of Capannelle, near *caposaldo* 37, the *specus* of the *Tepula* occurs in a ditch. It lay below that of Aqua Iulia, but above that of Aqua Marcia. After the reservoir, all three aqueducts ran on the same arches, the *Tepula* doing so for the rest of its course above ground. It is therefore described with the Marcia.

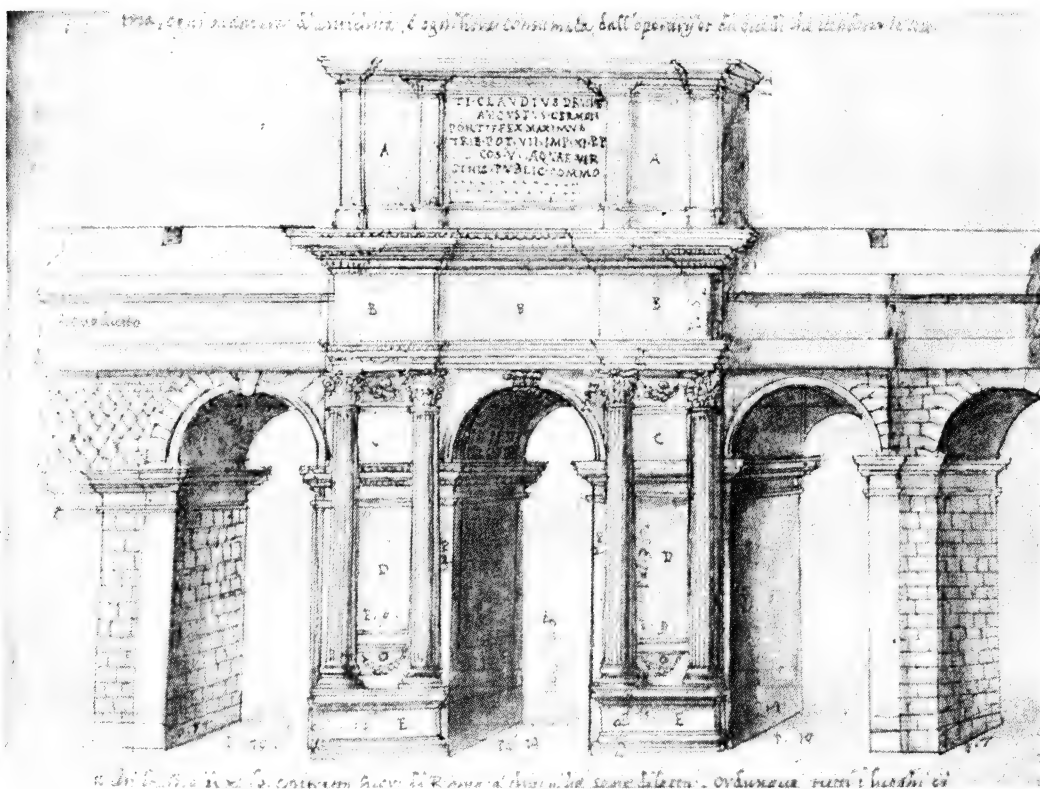
¹ See *PBSR. cit.* 218.

² For the remains of the road leading to the springs see Lanciani 82: 294; *PBSR.* iv. 131; v. 221.

³ *Atti Nuovi Lincei*, 1876, 36. There had been some discussion as to which were the real springs, owing no doubt to a controversy over the water-rights; see Ponzi, *Sulla scomparsa dell'Acqua Tepula nel condotto del Sig. Principe D. Fr. Pallavicini*; and De Rossi, MS., *Il bacino idraulico dell'acqua detta Tepula e la scomparsa di una delle sorgenti spettante al Principe Don Pallavicini*, Roma, 1875.



a. AQUAE MARCIA-TEPULA-IULIA, AT PORTA TIBURTINA
(After Giovenale)



b. AQUA VIRGO: LIGORIO'S DRAWING OF ARCH AT VIA LATA

V. AQUA IULIA

ACCORDING to Frontinus the Aqua Iulia was constructed by Agrippa in 33 B.C. and repaired by Augustus in 11-4 B.C., with the rest of the aqueducts then existing.

'Later, when the Emperor Caesar Augustus was consul for the second time, with Lucius Volcatius, in A.U.C. 719¹² (33 B.C.), Marcus Agrippa, as aedile after his first consulship, drew another separate source of supply, also tapping the Tepula, two miles along a by-road at the twelfth milestone from the City on the Latin Way, to the right going away from Rome. The name Iulia was given to the whole supply by its builder, but since the waters were again divided for distribution, the name Tepula remained. The conduit of Iulia has a length of 15,426½ paces; 7,000 paces are above ground, of which near the City, beginning at the seventh mile, 528 paces are on sub-structures, the rest on arches for 6,472 paces.

'Past the head of Aqua Iulia runs the water called Crabra. Agrippa left it out of the supply, either rejecting it as bad or thinking it should be left to the landowners of Tusculum; for this is the water which all the villas in that district receive in turn, allotted on fixed days in fixed quantities. But with less restraint, our water-men have always claimed part of it to supplement the Iulia, without increasing the Iulia's supply, which they drained by distributing it for their own gain. I therefore shut off the Crabra and, by the Emperor's command, gave it back to the Tusculans, who now, perhaps not without wonderment, receive it all without any idea of the reason for the unusual abundance of water. The Iulia, on the other hand, by cancelling the pipes through which it was secretly robbed, has maintained its normal supply even during notable drought.'¹

'Iulia is credited in the records with a capacity of 649 *quinariae*. Gaugings could not be made at the source, because this is composed of several tributaries.'²

A different tradition is conveyed by Dio Cassius, who states that the Aqua Iulia was introduced³ late in 40 B.C., at the end of Agrippa's praetorship. If this is true, Frontinus has made the mistake of assigning too much work to the aedileship of 33 B.C., and the Aqua Iulia might be considered as the completion of some scheme of the Dictator's. The tradition represented by Dio goes against Frontinus on the matter of restoring the Marcia⁴ also, and there is much to be said for spreading the work over a longer period.⁵

Several independent *cippi* of Aqua Iulia are known, all of the period of Augustus, and all bearing the inscription: IVL(ia). | IMP(erator) CAESAR | DIVI F(ilius) AVG(ustus) EX S(enatus) C(onsulto), followed by the number and the interval. They conform in type to those of the Anio

¹ Frontinus, 9.

² Id. 69.

³ xlviii, 32.

⁴ xlix, 49. See p. 89, n 6.

⁵ The assignation of Aqua Iulia, to 40 B.C., would provide the best link between Vitruvius and the aqueducts of Rome. He was retired by 31 B.C. (*De Arch.* i, *praefatio*; cf. ii, *praefatio*) and was engaged upon armaments for some time before then. But Frontinus (25) records a tradition connecting him with the standardization of pipes, which he certainly had considered (*De Arch.* viii. 6, 4). This would go well with his earlier services to the Dictator (*De Arch.* i, *praefatio*).

Vetus and Marcia, erected by Augustus during the same period. Those discovered bear the numbers:

302, found¹ on the left bank of the Torrente Squarciarelli, 200 m. from the paper-mill and almost opposite the Abbey of Grottaferrata. It is now in the Abbey Museum.

281, found at Campovecchio,²

157, found at Capannelle,³

156, two *cippi*, not noted as a pair in *CIL*.⁴

154, two *cippi* in this case also,⁵

153, a fragment only.⁶

The last group, 154-6 was found north-west of Casino Bertone at Capannelle.⁷ No. 156 was of tufa and the rest of *peperino*. In all cases the interval is 240 feet except in that of No. 157, where it is 250 feet, no doubt, as Mancini⁸ conjectured, because of the existence near it of the *piscina limaria* of the Anio Novus.

There was also found at Squarciarelli, near the second intake of the large mill, a *cippus*⁹ of A.D. 14, bearing the number 2. It reads [I]VL(ia) | [IMP.] CEASAR. D[I]VI. F(ilius). AVGVSTVS | PONTIF(ex) MAXIM(us) | [TR]IB(unicia) POTEST(ate) XXXVII | EX S(enatus) C(onsulto) II. The number seems perfectly clear; and one can only suppose that Augustus in the last year of his reign began a new numbering from the springs, of which no other trace exists.

THE springs of Aqua Iulia may be placed not far from Ponte degli Squarciarelli.¹⁰ Frontinus gives the distance from Rome as two miles to the right of the twelfth mile of Via Latina. This would take us even beyond the Acqua Algidosia, but it is probably not to be taken as an accurate measurement. *Cippus* 302, described above, gives the length of the channel as 14½ miles from the point at which it stood to Rome, while Frontinus gives the total length as 15½ miles. Springs are now to be seen about 200 m. below the bridge, in the bed of the stream at about 350 m. above sea level; and, as Lanciani notes, while little or no water may be passing under the bridge, the springs themselves¹¹ are plentiful. Rocchi¹² speaks of masses of travertine which served for the intake, and states that he believes that he had seen the *specus* at three points. These springs may, I think, be safely

¹ *Not. Scavi*, 1887, 82; *CIL*. vi. 31563 b = xiv. 4278.

² *Not. Scavi*, 1914, 68.

³ *Ibid.*, 1925, 51.

⁴ *Ibid.*, 1887, 73, 558; *Bull. Com.*, 1886, 313; *CIL*. vi. 31563 a.

⁵ *Not. Scavi*, 1887, 559, omitted in *CIL*. vi. cit.

⁶ *Not. Scavi*, 1887, 559.

⁷ There is a sketch-plan by Lanciani *ibid.*, 1887, 558; cf. also *Sched. Vat.* 37, f. 37.

⁸ *Not. Scavi*, 1884, 155.

⁹ *Ibid.*, 1893, 240; *CIL*. vi. 31563 c. *EE*. ix, p. 493, no. 970. It is now in Grottaferrata Abbey. In *PBSR*. v. 386 the number is wrongly said to be mutilated.

¹⁰ No additional information has come to light since 1910, when I wrote upon this aqueduct in *PBSR*. v. 386, where the original text of Holste will be found. For the road, cf. *ibid.* 227-8; *Lanciani*, 83: 295 ff.

¹¹ They have an ordinary minimum flow of 170 litres per second. *Lanciani*, 84: 296; cf. *Bilder*, 235; also *Lais*, op. cit. 31.

¹² *Diss. Pont. acc. arch.* ser. II, vol. vii (1900), 237 fin.

attributed to Aqua Iulia. Holste considered the fountain of the Acqua Algidosia (or, as it was called in his time, d'Angelosia) to be the real starting-point of the aqueduct.¹ There is, however, no actual portion of its channel to be seen, and it is impossible to see now whether the brickwork at that fountain is ancient, because the fountain has now been enclosed. Rocchi,² on the other hand, records his discovery of an ancient channel, 10 to 12 m. above the level of the modern fountain of the Squarciarelli, which was running towards the Acqua Algidosia or del Canalicchio. He believed that he had found it again lower down, in Vigna Passamonti near Villa Montioni, and also near Fontana Piscaro. These remains the author has not seen.

Rocchi rightly observes that this is the only water to which Frontinus' description would apply. While Holste equally correctly

¹ *Cod. Dresd.* F. 193, f. 41^v ff. 'On September 14th, 1649, I was at Grottaferrata, and from there I was led by a man who had a thorough knowledge of the locality, first by a straight road to the east, by which it is possible to drive to Marino and Vellettri by turning off from the Via Latina at the twelfth mile, that is, near Grottaferrata. After going about 600 paces one reaches, close to the road, a fountain built by Cardinal Alessandro Farnese, Abbot of Grottaferrata; it is generally called "la fontana dei Squarciarelli" and it is close to the Crabra: it bears the following inscription—*Alexander Farnesius Card(inalis) aquam Tepulam ad publicum usum hoc extracto vase collegit* M.D L XVII. But the water of this fountain does not rise by any means at this point, or near by, but is brought to it by a subterranean channel and then on to the aforesaid monastery of Grottaferrata. But there is no doubt that it is collected higher up from one of the sources of the Iulia. Near this Farnese fountain on the left of the Crabra springs of very limpid water are clearly to be seen, which, there is no doubt, once formed part of the Iulia; and above these springs on the hill lies the vineyard of Tomaso Vitacci, who, while digging a deep well, came upon the old aqueduct, through which the water even now runs with considerable noise.

'Ascending slightly from the Farnese fountain, we finally left the Via Latina, going off to the left for more than 1,000 paces, where on the left of the Crabra a conspicuous spring flows forth from a cave hewn out by human agency, and at once joins the Crabra. It is generally called "la fontana d'Angelosia". The cave is cut out like a shrine, and is closed by an arch of Roman brickwork, and the mouth or front itself shows traces of ancient brickwork. It is certain that this was the main spring and the head of the Iulia. A little higher up than the fountain in a level marshy spot other springs are collected and are conducted into a reservoir or cistern, generally called "Le Botte" and thus below these springs the Crabra begins in a very marshy place planted with reeds. These upper springs are taken from Le Botte by rock-hewn channels to the villas of Frascati, and I do not doubt that these springs with those which lie close to them once formed the Crabra. All these springs rise in the territory of Molana on the very boundary of the territory of the Abbey of Grottaferrata. But the Crabra, which even now is conveyed to Rome in its own channel, consists of two branches, one of which runs down from the valley of Grottaferrata and is called the Marrana, and receives the stream of the Acqua Ferentina which runs down from Marino a little way above the bridge at the tenth mile. Beyond the Marrana Mariana the Marinella rises.'

Another inscription given by Volpi (*Vetus Latium*, viii. 89) shows that Cardinal Carlo Barberini, despite his intimacy with Holste, was unaware of his views on the subject, for the name Tepula still recurs: *Carolus Barberinus Card(inalis) Abbas commendatarius aquam Tepulam iterum dilapsam instauratis amplificatis auctis ductibus publicae utilitati et privatis usibus monasterii et aerariae copiosiore restituit anno MDCLXXXVIII.* In *Barb. Lat.* 9898, f. 21, there are views of the Farnese fountain and of the Fontana d'Agneloscia (*sic*) and notes, from some local informant, not in Holste's own hand. The measurements of the latter are given as 12½ palms (2.66 m.) deep; 15 (3.34 m.) high, and 8 (1.76 m.) wide. The Botte reservoir is said to be 8 palms (1.76 m.) each way.

² Op. cit. 35.

points out that the springs of the Crabra rise in the Valle della Molara (as Lanciani¹ later observed, at 612 m. above sea-level) under Colle Bartolucci, north of the eighteenth mile of Via Latina. Their water is now conveyed to Frascati by the Acquedotto Aldobrandino, constructed early in the seventeenth century and restored by Canina in 1838–9.² The water now brought to Rome by the Marrana Mariana is, therefore, that which fed the Aqua Iulia,³ and not that of the Aqua Crabra, as Holste and even Fabretti believed.

Only the remains noted by Rocchi can safely be attributed to the actual *specus* of Aqua Iulia. The channels some 200 m. west of the Ponte degli Squarciarelli and all those in the Valle Marciana appear to be medieval⁴ or modern, for the water has naturally been constantly used for various purposes. Thus, no reliable record of discoveries occurs until we approach Casino Bertone, a good mile before the aqueduct emerges on arches. Here some of its *cippi* were discovered in 1887, and another in 1925. Of these, no. 157 appears not to have been *in situ*. But the pair numbered 156 were close to their original position; and one was actually standing erect, 50 m. from the north-east angle of Casino Bertone, and 115 m. north of the *piscina* of Aquae Claudia and Anio Novus.

It is, unfortunately, not clear whether the *specus* was actually discovered. Lanciani's first report⁵ states that *cippus* 156 was found 'set up parallel to the *specus* of Aqua Iulia, from the external face of which it is 1.35 m. distant'; and Gatti adds⁶ that this face was in *opus reticulatum*. But it can really have had nothing to do with the *specus*: for Lanciani's second report states that the channel ran in the *cappellaccio*, too deep to have been brought to light. This agrees with the fact that near *caposaldo* 37 the bottom

¹ Lanciani, 110: 322.

² Tuscolo, 85.

³ Lanciani, 113–15: 325–7; Lais, *Il rivo dell'Acqua Mariana* (Grottaferrata, 1913); Muratori, *R.I.S.* iii. 1. 420. The *locus classicus* on the Marrana Mariana and its canalization by Pope Calixtus II in 1122, using part of the *specus* of Aqua Claudia just below Centroni, is in *Lib. Pont.* ii. 379. 'He also drew water from the old channels and brought it to the Porta Lateranensis (Porta S. Giovanni), and there caused a pool for watering horses to be constructed. He also built very many mills upon this same watercourse, and most carefully ordered many vineyards with fruit trees to be planted near this same pool.' The idea that the stream was of classical origin dies hard. The opinion that it fed the *euripus* of the Circus Maximus was revived by Pesarini (*Studi romani*, ii. 413), who wished to identify it with the *amnis circi*, a conjectural reading in *Lib. Pont.* i. 507. Before the Marrana was created, the water of the ruined Aqua Iulia ran to waste in the Fosso del Luastro, and farther down, but quite exceptionally, in the Fosso di Tor Sapienza.

⁴ Lais, *op. cit.* 10, states that remains of Aqua Iulia were recently found in the Valle Marciana, citing a manuscript by Giuseppe Tomassetti, *Cenno storico sull'Acqua Mariana* (1888); but the aqueduct is referred to as medieval in Tomassetti, *Campagna Romana*, iv. 330, as well as in *Not. Scavi*, 1887, 82, which is the original report by Tomassetti, where its length is given as 40 m.

⁵ *Not. Scavi*, 1887, 558.

⁶ *Bull. Com.*, 1886, 313.

of the *specus* of the Iulia is 70·789 m. above sea level, and that of the Claudia 75·00 m. Here, where the bottom of the Claudia is about on the surface, the *specus* of the Iulia must lie at least 4 m. below ground.

Some 100 m. south of the Marrana Mariana, and nearly a mile west of the modern Via Anagnina, at a point where a *puteus* of the Anio Novus is marked in the map, the author has seen two *cippi* of tufa, each 0·55 m. wide, 0·24 m. thick, and, 4·58 m. (15½ Roman feet) apart; and farther on there is another pair, each 0·53 m. wide, 0·25 m. thick, and 4·70 m. (15¾ feet) apart, as measured in both cases from the inner sides. Their direction suggests that they belong more probably to Aqua Iulia than to Aqua Marcia, especially since a ditch, some 2 m. deep, to the west of the second pair did not expose a *specus*. On the other hand, the presence of deposit may go against this identification; for Aqua Iulia has none, to the author's knowledge.

About a kilometre farther on, the bottom of the *specus* of Aqua Iulia came to light in a ditch. It lay about 100 m. to the north of *caposaldo* 37 and 0·80 m. below it, which would put it at 70·789 m. above sea-level. Presently the aqueduct emerges above ground. The *specus* of the Tepula and the Marcia are already below it; and the *piscina* of which Frontinus speaks must be placed somewhere between Casino Bertone and this point.¹ 'Of these aqueducts', observes Frontinus, 'six are received in covered settling-tanks, on this side of the seventh milestone on Via Latina, where they take breath, as it were, after their run, and deposit their sediment. Their volume is also determined by gauges placed there. Three of them, Iulia, Marcia, and Tepula, are carried by the same arches from the catch basins onward. The Tepula, which, as explained above, was tapped and added to the Iulia, now receives its own quota of water from the basin of the same Iulia, and runs in its own conduit in its own name. The topmost of the three is Iulia; the Tepula is lower, then the Marcia.'² In a second context he notes that 'At the sixth milestone from the city, all the Aqua Iulia is received in a settling-tank, where its volume, according to the visible gauges, amounts to 1,206 *quinariae*,³ more than in the Records by 557 *quinariae*.'⁴

¹ Parker, *Aqueducts*, Diagram vii = *Historical Photographs*, 696 gives a plan and section of the *specus* which, he says, is visible 'near Sette Bassi', with a branch to turn off the water for the supply of the Villa. This was seen about 1850 by Maraldi, and probably refers to this same section of the aqueduct. The main *specus* was lined with *opus reticulatum*, and the branch with brickwork. Nothing is to be seen at present, and it has probably been destroyed, as he notes that it was at the ground level.

² Frontinus, 19. He had already stated (*ibid.* 8) that the Iulia was the third highest in level.

³ Or 50,043 cubic metres in 24 hours.

⁴ Frontinus, 69; Bennett notes in loc. 'Iulia was received into a catch basin: (1) The measurements there taken showed its volume to be 1,206 *quinariae*, while the records

The 528 paces of substructures belonging to this aqueduct must naturally be sought where the aqueducts begin to emerge above ground, and not at the City end. But the identity of this measurement and the length of the arches with those given for Aqua Marcia shows that the figure refers to the sector already described,¹ where *Aquae Iulia* and *Tepula* run on the arches of the Marcia.

credited only 649 *quinariae*, a discrepancy of 557 *quinariae*; (2) there were delivered in all 993 *quinariae*, 344 more than were credited in the records, but 213 less than the gauges showed at the reservoir. The 162 *quinariae* received from Claudia are not reckoned in computing this loss.'

¹ Cf. *supra*, pp. 128-9.

VI. AQUA VIRGO

FRONTINUS¹ gives the following account of the Aqua Virgo: 'Twelve years² after he had constructed the Julian aqueduct, and after his own third consulship,³ in the consulship of Gaius Sentius and Quintus Lucretius,⁴ Agrippa also brought the Virgo to Rome, taking it from the estate of Lucullus. We find that the 9th of June was the day on which it first began to flow in the City. The aqueduct was called Virgo,⁵ because a little girl showed some springs to the soldiers seeking water; and when the diggers followed these they found an enormous volume of water. The shrine⁶ at the spring exhibits this initial stage in a picture.' The head of the Virgo is at the eighth milestone of Via Collatina, in the marshes, surrounded by a cemented tank isolating the gushing springs: this supply is also augmented by several other tapplings. Its course is 14,105 paces long, out of which there is an underground channel for 12,865 paces: it is above ground for 1,240 paces, on substructures at various points for 540 paces, and on arches for 700 paces. The underground channels of the extra tapplings make up 1,405 paces.'

'In level the Virgo follows the Anio Vetus, and is followed by the Appia. Both are derived from districts near the City, and therefore could not be made to rise so high as the rest.'

'Neither the Virgo nor the Alsietina have source-basins, that is, settling-tanks. The arches of the Virgo begin below the Gardens of Lucullus, and end in the Campus Martius, behind the Saepta.'

'The Virgo is credited in the Records with a volume of 652 *quinariae*. I could not get its measurement at the source because it is made up of several sources, and enters its channel rather slowly. But near the City, at the seventh milestone, on the estate now belonging to Ceionius Commodus,⁹ where it runs faster, I measured it in all as 2,504 *quinariae*, 1,852 *quinariae* more than in the Records. Our statement can be very quickly checked, for this amount is credited as consumed, that is, 2,504.'

Other references in ancient authors tell us little: Ovid refers to it as

¹ *Frontinus*, 10.

² Fourteen, if the dates are correct.

³ 27 B.C.

⁴ 19 B.C.

⁵ Plin. *N.H.* xxxi. 42, tells another story, a patent invention, of the origin of the name. 'Idem et Virginem adduxit ab octavi lapidis diverticulo duo milia passuum Praenestina via. Iuxta est Herculeus rivus, quem refugiens Virginis nomen obtinuit. Horum annuum comparatione differentia supra dicta deprehenditur, cum quantum Virgo tactu praestet, tantum praestet Marcia haustu, quamquam utriusque iam pridem urbi perit voluptas, ambitione avaritiaque in villas ac suburbana detorquentibus publicam salutem.' This evil was remedied by Frontinus, see p. 32.

⁶ The work *Ioannis Chifletii canonici Tornacensis Aqua Virgo . . . in vetere annulari gemma*, Antwerp, 1657 (republished in Graevius, *Thesaurus antiquitatum Romanarum*, iv, 1783 ff.) describes a gem with Agrippa on the obverse, and the chapel at the springs, with aqueduct-arches, on the reverse.

⁷ *Id.* 18.

⁸ *Id.* 22.

⁹ It had previously belonged to Lucullus. This Commodus was the adopted son of Hadrian, the father of Lucius Verus, through whom it became part of the Imperial Domain.

¹⁰ *Id.* 70.

ending near the temple of Iuturna in the Campus Martius,¹ and as remembered in exile, with 'the lawns of the Campus overlooking those fair gardens, the pools and conduits, and the water of Aqua Virgo.'²

In writing of Augustus, Dio Cassius³ states that, like so many other aqueducts, it was given the name Augusta. But this name, even if used officially, was not retained for any length of time, for it does not occur on the *cippi* of Tiberius or Claudius, both of whom restored it, nor in the Claudian inscription on the Arco del Nazareno.

Seneca refers to it as a pleasant water to bathe in;⁴ and it is also referred to casually by Statius⁵ in his description of the *balneum Claudii Etrusci*,⁶ being mentioned with the Anio and the Marcia as one of the waters which supplied it. Martial, in his description of the same building, also mentions it with the Marcia as a cold water, in which a plunge could be taken after a hot vapour bath.⁷ This estimate of its qualities, like Pliny's, is rather surprising; for nowadays the Marcia, the springs of which are at a considerably greater elevation, is certainly a good deal colder; while its hardness, though rendering it very palatable to drink, makes it hardly so healthy as the Virgo. Yet Martial speaks of the Virgo as exceptionally cold in two other passages.⁸

A restoration of the Aqua Virgo by Constantine is recorded in the following inscription, found in two pieces while laying the foundations of the Palazzo dell'Esposizione, in Via Nazionale.⁹

Imperator Caesar Fl. Constantinus Maximus Pius Felix Invictus Aug., Filius Divi Constanti, Nepos Divi Claudii, formam Aquae Virginis vetustate conlapsam a fontibus renovatam arquaturis eminentibus omnibus dirutam pecunia sua populi Romani necessario usui tribuit exhiberi, curante Centulio Valeriano V(iro) C(larissimo) cur(atore) aquarum et Miniciae, d(evoto) n(umini) m(aiestati)q(ue) eius.

In other words, Constantine restored the channel of the Aqua Virgo to the use of the Roman people at his own cost, after it had fallen by reason of its age, renewing it from the springs, and restoring all its lofty arches which had collapsed. No trace of this work is now to be seen.

In the time of Theodoric¹⁰ its purity is still praised. 'The Aqua Virgo

¹ *Fasti*, i. 463, *te quoque lux eadem, Turni soror, aede recepit, | hic ubi Virginea campus obitur aqua.*

² *Ex Pont.* i. 8. 38, (*mihi subeunt*) *gramina nunc Campi pulchros spectantis in hortos, stagnaque et euripi Virgineusque liquor.*

³ *liv.* 11, *τό τε ὕδωρ τὸ Παρθένιον καλούμενον τοῖς ἰδίοις τέλεσιν ἐσαγαγὼν Αὔγουστον προσηγόρευσε.*

⁴ *Ep.* 83, 5, *sic auspicabar in Virginem desilire.*

⁵ *Silv.* i. 5. 25.

⁶ *quas (nymphas) exceptura natatus Virgo iuvat.*

⁷ *vi.* 42. 18, *contentus potes arido vapore cruda Virgine Marciae mergi.*

⁸ *vii.* 32. 11 *sed curris niveas tantum prope Virginis aquas* (of one Atticus, who took his exercise by running in the Campus Martius); *xi.* 47. 6. *corpus perfundit gelida Virgine?*

⁹ *CIL.* vi. 31564; Lanciani, *Not. Scavi*, 1881, 320; *Bull. Com.*, 1881, 197 and pl. xiii.

¹⁰ Marini's mention of the discovery of a pantile, bearing two stamps of Theodoric (*Iscrizioni doliarie*, ed. De Rossi, 1156; *CIL.* xv. 1664, 1.), as found in 1791 in an old aqueduct near the Collegio Germanico, has been wrongly associated with the *Saepta*, and used as evidence of repairs to the Aqua Virgo in the sixth century; for in another account (*Arvali*, 620) Marini calls it 'a flange-tile which closed a conduit between the Piazza Navona and the Collegio Germanico'; the German College, in his day, was situated opposite S. Agostino, at the NW. angle of the *Thermae Neronianae*.

runs with delightful purity,' Cassiodorus¹ says, 'for while other waters during excessive rain are invaded by earthy matter, the Virgo's current runs pure as never-clouded sky.'

This water-supply, like the others, was cut off by the besieging Goths under Vitiges in A.D. 537 and carefully blocked with masonry by Belisarius² to prevent the channel from being used as a passage into the City. Nevertheless, a dramatic attempt was made, which Procopius relates as follows:³ 'And first they sent some men by night into one of the aqueducts, from which they themselves had drawn off the water at the beginning of this war. And with lamps and torches in their hands they explored the entrance into the city by this way. Now it happened that not far from the Pincian Gate⁴ the vault of this aqueduct had a sort of shaft in it, and one of the guards saw the light down this and told his companions; but they said that he had seen a wolf passing by his post. For at that point it so happened that the structure of the aqueduct did not rise⁵ above the ground, and they thought that the guard had imagined the wolf's eyes to be fire. So those barbarians who explored the aqueduct, upon reaching the middle of the city, where there was an upward passage built in olden times leading to the palace itself,⁶ came upon some masonry there which allowed them neither to advance beyond that point nor to use the ascent at all. This masonry had been put in by Belisarius, as an act of precaution at the beginning of this siege, as has been set forth by me in the preceding narrative.⁷ So they decided first to remove one small stone from the wall and then to go back immediately; and when they returned to Vitiges, they displayed the stone and reported the situation. And while he was considering his scheme with the best of the Goths, the Romans who were on guard at the Pincian Gate recalled among themselves on the following day the suspicion of the wolf. But when the story was passed round and came to Belisarius, the general did not treat the matter carelessly, but immediately sent some of the notable men in the army, together with the guardsman Diogenes, down into the aqueduct and bade them investigate everything with all speed. And they found all along the aqueduct the lamps of the enemy and the droppings from their torches, and, after observing the masonry whence the stone had been taken out by the Goths, they reported to Belisarius. For this reason he set the aqueduct under close guard, and the Goths, perceiving this, desisted from the attempt.'

It is evident that the water-supply was restored under Byzantine rule, for, as Lanciani notes, the aqueduct was restored by Pope Aadian I, in 774-86; *formam quae virginis appellatur, dum per annorum spatia demolita atque ruinis plena existerat . . . restauravit*.⁸ But in late times no attempt

¹ *Var.* vii. 6: 'currit aqua Virgo sub delectatione purissima . . . nam cum aliae pluviarum nimietate terrena commixtione violentur, haec aerem perpetue serenum purissime labens unda mentitur'.

² *B.G.* i. 19, 13, 18.

³ *Ibid.* ii. 9, 1-11.

⁴ It must, as a fact, have been a good distance: for as we have seen, the aqueduct passes under the wall at the Villa Medici, and comes southward to that point.

⁵ 'high', inserted in the Loeb translation should be omitted.

⁶ *παλάτιον*: the reference is to the *Domus Pinciana*, see *B.G.* ii. 9. For the stairs, see p. 170.

⁷ *Ibid.* i. 19, 18.

⁸ *Lib. Pont.* i. 520, n. 78.

was made to carry the restoration farther than the Fontana di Trevi. Indeed, the Einsiedeln Itinerary calls¹ the section immediately beyond the fountain *forma Virginis fracta*. This document also refers² to the Arch of Claudius in Via del Nazareno as *Forma Virginis*, as is shown by the fact that the legend is placed in the centre, showing that the road described (from Porta S. Petri to Porta Salaria) passed under it. The same arch is referred to as *monumentum* in a forged Bull³ of John III; and the road is referred to as *Via publica quae ducit sub arcara forme quae appellatur virginis* in a Bull of Agapitus in A.D. 955.⁴ Presently, at an unknown date, the supply failed.

The history of the various attempts at restoring the aqueduct to use cannot be discussed here in detail. The first were made by Nicholas V, who brought water as far as the Fontana di Trevi in 1453, but only from the Via Salaria, not from the original springs. Sixtus IV also partially repaired it. The restoration of the whole was finally begun by Pius IV, who unfortunately fell into the hands of a rascal named Antonio Trevisi, who muddled the affair to such an extent that the concession had to be withdrawn from him, and the work was only finished by the Pius V, in 1570.⁵

The numbering of the *cippi* of Aqua Virgo began at the edge of the Pinian Hill. Two *cippi*, each bearing the number I, were found together in the Villa Medici on 9 February, 1566,⁶ where the subterranean *specus* is still accessible by a stairway of 118 steps. The *cippi* belong to two different series, one erected by Tiberius in A.D. 36-7, the other by Claudius in A.D. 44-5, after his restoration of the aqueduct. All known examples seem to have been found *in situ*: and all are of travertine except *c*, which is of *peperino*.

	Number.	Interval in feet.	Erected by	Place of Publication.
<i>a.</i>	1	240	Tiberius	<i>CIL.</i> vi. 31565a = 1253a.
<i>b.</i>	1	240	Claudius	<i>CIL.</i> vi. 31565b = 1254.
<i>c.</i>	4	240	Tiberius	<i>CIL.</i> vi. 31565c = 1253b.
<i>d.</i>	15	240	Tiberius	<i>Not. Scavi</i> , 1910, 547.
<i>e.</i>	45	240	Claudius	<i>CIL.</i> vi. 31565d; cf. Lanciani, 123 : 335.

THE indications of Frontinus and Pliny agree in fixing the site of the springs of Aqua Virgo in a marshy basin not far to the left of the Via Collatina, 600 m. to the south of the railway station, and as much again from the farmhouse of Salone,⁷ a little before

¹ *Eins.* 4. 4.

² *Eins.* 2. 5.

³ Jordan, *Top.* ii. 670 (a description of the boundary of the parish of SS. Apostoli): *fit transitus super formam Virginis iuxta monumentum et deinde convertitur citra eandem formam continuo usque illuc ibi dicitur camella (cannella) eiusdem formae et exinde recolligitur per viculum capralicum.*

⁴ Kehr, *Italia Pontificia*, i. 63. 6; *Arch. soc. Rom. Stor. Patr.* xxii (1899).

⁵ Lanciani, 129 : 341; *Storia degli Scavi*, iii. 235, iv. 12; Pastor, *Storia dei Pape*, vii. 571, viii. 86. A full bibliography is given by G. De Angelis de Ossat, *Studio bibliografico sull'origine dell'Acqua Vergine*, reprinted from *Bollettino del naturalista*, xxvii, Siena, 1907.

⁶ *Cod. Vat. Lat.* 6038.

⁷ Built as a villa by Cardinal Agostino Trivulzio of Milan in 1525, and decorated with frescoes and stuccoes by Daniele da Volterra and Gianmaria da Milano: but they are now

the eighth ancient mile of the Via Collatina, which the aqueduct closely follows. The springs are at a very low level, only some 24 m. above the sea. Like those of the Alexandriana, they are produced by the appearance at the surface of subterranean water-courses running within the stratum of pozzolana, which must closely resemble streams above ground, having main courses which receive other affluents according to the undulations of the impermeable strata.¹ The channel is mostly subterranean² and retains no trace of antiquity on the outside. Its use for the present-day supply of Rome renders impossible an examination of the interior.

More considerable traces of ancient construction would seem to have been visible in the sixteenth century than now. Pirro Ligorio, if he may be regarded as a trustworthy witness, gives us some interesting information. We may perhaps disregard his statement that 'to the spring (the Romans) dedicated the Virgin with an eagle in her breast, as we have seen in one of the ancient sluices of the spring which Cardinal Trivulzio transported from its place to his *casale*'.³ But it is more interesting to note that the channel is said to have had groups of shallow steps in it, with sluices at each, occurring every two or three miles, for purifying the water: though by making the fall more rapid they would have helped it to lose what little head it already possessed when it reached the city. In any case, the total fall cannot have amounted to much, for the ground level at Piazza di Spagna at the present day is 18.37 above sea-level, or less than 6 m. difference from that at the springs. His statement that the bottom of the channel was lined with sheet lead in marshy places seems, however, extremely doubtful.⁴

hardly recognizable, and would be perhaps worth restoring (Tomassetti, *Campagna romana*, iii, 479 ff.). It is interesting to notice that the aqueduct was believed to be the Aqua Appia in Trivulzio's time, and that the correct identification with the Aqua Virgo only came a little later. This is clear from the inscription which the cardinal set up in his villa: *Aug(ustinus) Trivultius Cardinalis villam hanc ad Aquam Appiam secessum sibi animi causa paravit MDXXV.* ¹ *Aniene*, 73.

² Two drawings of the course of the Aqua Virgo, *Uffizi*, 4236 and 6819 may be noted. 4236 is certainly by Pirro Ligorio, as Hülsen has pointed out. It is a fine drawing in four sheets, measuring 1.685 m. long over all, and 0.582 m. high. It has, however, no archaeological importance. Ferri's attribution to Bartolommeo Rocchi (*Indice*, p. 205) should be rejected. 6819, by an unknown seventeenth-century hand, gives only a plan of the springs, and is of even less value.

³ *Cod. Ottob.* 3365, s.v. *Acqua Vergine*: 'al cui fonte dedicarono la Vergine con un Aquila in seno, come haueuo ueduto in uno delli antichi serragli d'esso fonte lo quale trasportò dal suo luogo il Cardinal Trivulzi nel suo Casale'. From the description it sounds more like a relief of Leda and the swan.

⁴ *Cod. Ottob.* 3373, s.v. *Piscina*, f. 13^v: '(l'acqua) si purgaua per uiaggio con alcuni scalonì i quali gradini erano a due e a tre miglia a poco più e meno, et ad ogni grado ui era chiuso un serraglio. Ella haueua nel principio del suo nascimento alcuni serragli di marmo coperti, acciochè l'acqua non saltasse sopra terra . . . et nelli fondi troppo aquesi . . . era il letto foderato di tegoloni di piombo.'

Ligorio also notes the existence of an ancient substructure, 10 palms (2.23 m.) high, at the place where it crosses the Fosso della Bocca di Leone, the first point at which it emerges above ground.¹ These same arches were restored by Lucas Paetus², though he does not describe them, and fitted with the ancient lion's head which serves as a fountain jet, and which probably gives its name to the locality.³

Just after these arches the modern Via Collatina goes southwest and joins the Via Praenestina; but the ancient road and the aqueduct kept on together for nearly two miles more, until, in the Tenuta del Portonaccio, on the right bank of the Valle della Marranella, the aqueduct takes a right-angled turn to the north. Lanciani⁴ thinks, and probably rightly, that Agrippa's engineers were anxious to avoid a tunnel as much as 33.50 m. (about 100 feet) deep and nearly three miles long, under the highest part of the city; and they therefore carried the aqueduct on under the Via Tiburtina at the third kilometre (about the third ancient mile) and through the Tenuta di Pietralata⁵ (where it passes deep under the channel of the modern Acqua Marcia) until it reaches the cliffs on the edge of the Anio, and perforce turns west. It then passes under the Via Nomentana, and emerges for the last time in the

¹ Volpaia (cf. p. 24) shows five arches: but no reliance is to be placed on this; for Fabretti, in his review of Kircher's *Latium*, in *Diss. acad. Corton.* (iii. 235) remarks: 'Ella non ha archi, ma quelle poche substruzioni a Boccaleone, ed in altre vallette, che esattamente riferisce Luca Peto, e noi riconoscemmo con il mio onoratissimo Signor Gio. Lucio, e parte di questi, che si danno a lei, toccherebbero all'Alessandrina, ma non stanno a suo luogo.'

Fabretti (in his map opp. p. 137: 133, *Diss.* III, tab. i, nos. 2-4) shows this substructure and one over the next stream to the west, the Fosso Gottifredo (3) where no traces of antiquity are to be seen now and where the pavement of the road (he is referring to the ancient Via Collatina) lay on top of it. His list is as follows (coming out from Rome): 2, *Alia (substructio) ad ripam Anienis, ad dextram Nomentanae*; 3, *Alia, sub ipso silice viae Collatinae* (we may note that the farm which in his time was known as Grotta dei Greci is now called Casale Bruciato); 4, *Alia, ad viam Collatinam, in Fundo di Boccaleone*.

Cassio (i. 136) notes the following: 'le xiv. miglia di cotesto Acquidotto per relazione avuta da Fabri, e Fontanieri, che hanno l'incombenza di quest'acqua, ed anche secondo la Pianta, e diverse carte del fù Gio. Battista Contini, che fin dal 1625 n'era Prefetto, conservate dal Signor Maffeo di lui figlio succedutogli nella carica, e che cortesemente mi ha communicate, si ravolgevano ne seguenti luoghi. Dalle prime sorgenti, che i Fontanieri dicono Bollori, dove è la Botta, o Piscina con muri arcuati, e forse coll'opra a signino, arrivando alla Rustica . . . correva per II miglia: d'indi a Boccaleone altre II dove è altra botte, o conserva con casetta: a Casal Gottifredo dove si vede la sola volta di sostruzioni passava I miglio a Casal Brugiato . . . I intersecando la via Tiburtina. A Casal Vittori, già d'Asti I alla Casetta con Botte nel fine delle Monti de Duchi Lanti, o Pietralata I . . . nel qual sito si veggono XXII archi, unica opra arcuata, che avesse nel suo corso la Vergine. . . . Daddove intersecando le vie Nomentana, la Collina, o Salara nuova ed antica, col giro di 3 miglia entrava nei Vigneti suburbani del Monastero di S. Silvestro in Capite ed altri Particolari, nel qual tratto scuopransi li molti Pozzi, o sfiatori coi suoi cappelli.'

² *De restitutione ductus Aquae Virginis* (Roma, 1570), A 4, A 7. Venuti (in Eschinardi, *Agro romano* (ed. 1750), 233, confirms his account, after visiting the aqueduct himself.

³ If so, he can only have replaced it, for the name occurs in 1547, see Volpaia, *cit.* p. 24; Tomassetti, *op. cit.* iii. 470.

⁴ Lanciani, 122 : 334.

⁵ Here are more modern substructures, with no trace of antiquity.

valley between this road and the Via Salaria, below S. Agnese. Here Ligorio¹ gives a drawing of thirteen arches of concrete faced with brickwork and *opus reticulatum*, the piers being faced with the former, and the *specus* with the latter. Volpaia only shows four improbably high arches. Ligorio's view is valuable, for no trace of antiquity is now to be seen, the whole having been rebuilt at an uncertain date—probably not very long ago, as Fabretti shows the substructure in his plan.² It is faced with brickwork, so well laid as to be at first sight deceptive. From this point the aqueduct runs under the Via Salaria and on in a westerly direction under the royal Villa (Villa Savoia, formerly Villa Telfener) until it reaches an ancient road, the present Vicolo di S. Filippo,³ where its 45th *cippus* stood until not very many years ago. It turns and follows this almost due southward for a while, then runs south-westward, passing under the Via Salaria Vetus, until it reaches the former Vigna Cartoni, now the Valle Giulia, where its 15th *cippus* was found in constructing the German Fine Art Pavilion in 1910.⁴ It next continues under the Villa Borghese, just inside which, in the former Vigna della Valle at Muro Torto, its fourth *cippus* was found in Fabretti's time;⁵ and so passes below Aurelian's Wall and on into the Villa Medici, where its first *cippi* stood. The old channel was retained in the restoration of the sixteenth century, except in passing through the Monti Parioli, where Mario Frangipane and Rutilio Alberini shortened the course of the aqueduct by having a cutting made through the hard tufa rock.⁶

Frontinus says that, like the Appia, the Virgo had no *piscina*: the water not being as hard as that of the rest, it needed no settling-

¹ *Cod. Taur.* XIV, s.v. *piscina* (the text in *Ottob. cit.* is slightly different): 'Uscendo di sotto terra, parte per opera di muro, si scuopre, et di poi di nuovo sotto terra entra per un altro spatio, con varii acquisiti, il suo rivo cresce, et uscendo di nuovo di sotto terra nel principio per luogo tutto murato, ne va à trovare un opera Arcuata, parte lateritia et parte reticulata; passa in questa sorte di costruzione, qual vi mostro in questa prima forma disegnata, con la parte più alta fatta di Reticoli di Tufo, con li fianchi di tre palmi grossi molto debolmente fabricata circa i muri, ma vi era il calcestrutio grosso di quattro oncie, molto bene battuto et condensato et palmentato, et li Reticoli sono di questa fatta, tagliati et ben commessi in calce. Ma prima, che arrivi a questa luogo, variamente per più luoghi per sotto terra, per uno grande spatio, traversando i campi che sono infra due Vie, la Tiburtina et Nomentana. Di quivi sottoterra, più oltre, si scuopre alle valle presso della Via Collatina, o Collatia, ove lasciando la substructione, passa, sopra un'altra opera composta di muro alto da dieci palmi: ritrovando, in testa della fabrica il colle, si mette ivi dentro, ne più si vide l'acquedotto sopra a fabrica alcuna sinche non uscito dal Monte Pincio,' &c. . . . Subsequent (incomplete) corrections in the text show that Via Collatina is an obvious mistake: we should read Nomentana.

² At p. 137: 133, 'substructio Aquae Virginis' Diss. III, tab. i. no. 1.

³ *PBSR.* vii. 9, 10.

⁴ *Not. Scavi*, 1910, 547.

⁵ *Inscriptiones* 661, 512 'repertus prope moenia urbis in vigna Vallaea a Muro Torto'; Lanciani, *Forma Urbis*, 1.

⁶ Paetus, op. cit., cf. Cassio, i. 309; Lanciani, 122: 324.

tank. But Fabretti drew¹ a disused *piscina*, full of mud, in the Vicolo del Bottino, near Piazza di Spagna. It lay at the end of an ancient branch-aqueduct, 100 m. long, and its remains were destroyed when the lift to the Pincio was made,² one of its chambers³ becoming the waiting-room.

Cassio⁴ gives the following account of what may, Lanciani thinks,⁵ have been a part of the constructions connected with another branch of the Aqua Virgo, running north-west from this point. 'On the 6th of January, 1750', he says, 'I was invited to . . . the Casino belonging to Signor Cristoforo Cenci, in the place called *Orti di Napoli* at the bottom of the Pincio, below the Villa Medici in a straight line to the high *casino* called S. Gaetano.⁶ . . . Matioli showed me an excavation he had made on the north-east side of the courtyard to a depth of about 12 palms (2.65 m.) in which there were many small square brick channels to be seen; they ran underground in a line to the north of the Porta Flaminia, and some of them entered on the south into a large arched channel 10 palms (2.23 m.) high reaching the ground level in the courtyard, and 6 (1.33 m.) wide, which ran straight to Piazza di Spagna, in the same direction as that which the Acqua Vergine now takes, which runs above this same courtyard, at the end of which on the east is the cistern with the stone, on which are cut the names of those who have a right to the water, and the number of *oncie* granted them. At the side of the main arched channel another smaller one followed its line, which was not arched, two palms (0.44 m.) wide and about 3 (0.66 m.) deep. . . . He also showed me many remains of walls, which served to level off the uneven slope of the hill . . . and assured me that he had found traces of pipes for watering the gardens on the slope, and showed me a rectangular sluice with a gate of white marble . . . under the house where he lives. Descending a staircase of 16 steps, I saw a clear perennial spring gushing forth right under the sluice.'

Lanciani⁷ suggests that the pipe *Amethysti Drusi Caesar(is)* may have started from it. But it seems very doubtful whether there is any connexion with the Aqua Virgo, and we cannot be

¹ 125: 114, tab. xvii. 'Romae sub Pincio colle aquam Virginem parum diverse limum sordesque olim deposuisse ex peritis accepimus, et ut licuit, citra mensurarum fidem cras-saque Minerva delineavimus tab. xvii (Diss. II): quia locus iam diu inaccessus, utpote coeno repletus suoque muneri inutilis remanet, aquariis et castellariis nostris, non quidem Nymphis sed Mercurio perbelle litantibus.' The drawing was reproduced by Canina, iv, pl. 231, fig. 6.

² Lanciani, *Storia degli scavi*, iii, 125.

³ There is a model of it in the Antiquarium on the Caelian, photographed by Herschel (p. 199). Lanciani (*Forma Urbis*, 9) shows it as if the two chambers were unequal and ran from east to west: the model makes them equal and running from north to south. In the model it is incorrect to show *both* sides of it, as if it were a free-standing structure; so the corrected drawing of De Montauzan (*Les Aqueducs antiques de Lyon*, 309, fig. 122) is to be preferred.

⁴ ii. 347. ⁵ Lanciani, 124: 336. ⁶ Lanciani, *Forma Urbis*, 1. ⁷ Lanciani, 231: 443.

sure of either the levels or the line of the channel of which Cassio speaks. Cassio is certainly wrong in saying that the Aqua Virgo runs above the courtyard, as Lanciani's *Forma Urbis* shows.

Lanciani further states that the point where the *cippi* started was the point where the aqueduct emerged from the rock of the Pincio, and the arches began. But his *Forma Urbis*¹ shows that the aqueduct must have kept below ground along the side of the hill for at least another 400 m., throughout the whole length of the Via Gregoriana, as far as the apex of the triangle between the Via Francesco Crispi (formerly Via Capo le Case) and Via di S. Giuseppe. Here, in fact, the aqueduct turned at right angles (from south-east to south-west), and the arches began² a little farther down, about half-way to Via Due Macelli. It then crosses the Via del Nazareno, on the north-east side of which a door leads into the channel, with the arms of Sixtus IV over it: and on the south side of the street, in the courtyard of house no. 14, is an aqueduct-arch in travertine, followed by an archway³ of ornate type, also in travertine and projecting slightly from the main aqueduct on each side. It was built by Claudius in A.D. 46 over an ancient street, which branched eastward from the Via Lata.⁴ Both sides of this structure have been cleared, but little more than the attic is visible. This bears an identical inscription on each side, which runs: *Ti. Claudius Drusi F. Caesar Augustus | Germanicus Pontifex Maxim. Trib. potest. V. Imp. XI. P. P. Cos. desig. IIII. | arcus ductus aquae Virginis disturbatos per C. Caesarem | a fundamentis novos fecit ac restituit.* The destruction of the arches mentioned here was probably due to the commencement by Caligula of an amphitheatre near the Saepta,⁵ which was never finished.

¹ Sheet 9, where he marks it as *rivus Aquae Virginis nunc intermissus*.

² Piranesi makes the arches begin behind the Collegio Nazareno, *Antichità*, i, tav. 4, no 72; Lanciani, *Forma Urbis*, 16.

³ Hülsen-Jordan, *Top.* i³. 457, who cites drawings by Fra Giocondo (*Uffizi* 1541) and Sallustio Peruzzi (ibid. 666); Piranesi, *Campo Marzio*, pl. 20 (actual state), *Antichità*, pl. 12, fig. 2 (restored); Rossini, *Antichità Romane* (unnumbered); Canina, op. cit. iv. pl. 223; *CIL.* vi. 1252 (cf. add. p. 3128); *Bull. Com.*, 1886, 32; cf. Lanciani, *Sched. Vat.* 37. f. 151. The arch is referred to by Martial (iv. 18. 1) *Qua vicina pluit Vipsanis porta columnis, et madet assiduo lubricus imbre lapis.* In Ligorio's time it was in the house of Monsignor Fabio Vigili, Bishop of Spoleto, who, he says, in digging found a large statue of a Triton in marble, which was later in Palazzo Farnese.

⁴ The exact course of the streets which run in various directions from the Arch must be left undecided. Lanciani marks (*Forma Urbis*, 15-16) a street coming east from Via Lata, to pass under the Arch; from which street the church of S. Maria in Via took its name (Hülsen, *Chiese*, 375). South-east of the Arch it turns south-west and runs south-east of the aqueduct, throwing off a branch to the north-west under the Palazzo del Duca di Ceri, which is indicated as having been crossed by a monumental arch. Both aqueduct and road then turn south, and the latter becomes the Vicus Capralicus. With this Hülsen agrees (Hülsen-Jordan, *Top.* i. 3. 459), though his *Forma Urbis* marks matters differently.

⁵ Suetonius, *Gai.* 21; cf. Cass. Dio, lxix. 10, 'inchoavit autem aquaeductum regione Tiburti, et amphitheatrum iuxta Saepta; quorum operum a successore eius Claudio alterum peractum, omisum alterum est.'

Lanciani noted that from what little could be seen of the lower part of the Arch in the cellars of the Casa del Bufalo, and from Piranesi's actual-state drawing, the piers below the archway seem to be reconstructed, to the same type as those of the Claudia and Anio Novus, in heavily bossed blocks of *peperino* with impost-moulds of travertine. This is confirmed by the modern clearing. Piranesi notes that the work was later strengthened with brick-faced concrete, and that the ancient *specus* was 1.114 m. lower than that of the restored aqueduct which crowns it.

In 1885, an excavation to the south of the Arch, in the garden which formerly belonged to the famous Angelo Colocci, then to the Bufalo family¹ and later to the Polverosi, led to the discovery of ordinary piers with their arches, which were built of travertine, extremely well preserved. Thus, the standard arches of the aqueduct at this point evidently had a monumental character, as had those in the Campus Martius. Remains of the *specus* were found in January 1899, near the corner of Via della Stamperia and Via del Tritone; but no details are available. Further remains of arches were found in the reconstruction of Palazzo Poli, in Piazza Poli, in 1889;² and indeed remains are known all along the course from the Arch of Claudius, so that Lanciani is able to show a continuous line of piers up to the Fontana di Trevi,³ where there is naturally an interruption. At the Fontana di Trevi, Du Pérac, in his bird's-eye view (1577), shows an arch immediately south-west of the Fountain, crossing the Via delle Muratte. This arch is also indicated by Tempesta (1593), but it had been removed when the 1640 edition of Du Pérac's view was published: it was, in all probability, an arch of the aqueduct. After crossing the Via delle Muratte, the aqueduct turned, as if it had just crossed an ancient road coinciding with that street in continuation of the ancient road below Via del Lavatore. The direction of the aqueduct is now WSW., but there is no trace of it until after the Via delle Vergini, which does not follow an ancient street line. Immediately to the west of that street Lanciani shows four piers, and then, after a short interval, some more.⁴ Two of this last group were found during the construction of the Galleria Sciarra, between the oratory of the Crocefisso (or of S. Marcello) and the back of the

¹ Lanciani, *Storia degli scavi*, i. 204.

² Lanciani, *Sched. Vat.* 37, f. 153 (15 Feb.). He had already mentioned the Casa Poli in this connexion (125 : 337).

³ The *ecclesia S. Hippolyti cum sua pertinentia, quae est foris infrascripta formā*, mentioned in a Bull of 8 March (*Arch. soc. rom. stor. patr.* ci. 4962; Kehr, *Italia pontificia*, i. 83. 7), was near S. Anastasio in Trivio, which, according to Hülsen (*Chiese*, 262, and pl. ii. *Fm*), lay on the south-east side of the Via del Lavatore, between the Vicolo Scanderbeg and the Via della Panetteria; and the arches in question are therefore those to the north of the Fontana di Trevi.

⁴ *Forma Urbis*, 15.

stage of the Teatro Quirino. They are described¹ as 2.50 m. wide, built of tufa or *peperino*, with an impost-mould of travertine. To the south of them lay a building, the nature of which is uncertain.² Finally, in the courtyard of Palazzo Sciarra itself, four very fine arches of tufa, with travertine keystones and travertine string-moulds below the *specus*, were brought to light in 1887.³ The span of each arch was 3.15 m. and the total width of the aqueduct was 3.60 m. The bottom of the *specus* was of chips of selce and the sides of brickwork.⁴ Opposite the door of Palazzo Sciarra, just north of the Saepta, the Via Lata was reached; this is the modern Corso Umberto Primo. The whole of this stretch of arches, from Fontana di Trevi to the Via Lata, runs in a gentle curve, and is spoken of as *Forma Virginis fracta* in the Einsiedeln Itinerary.⁵

The Via Lata, the important continuation of Via Flaminia through the Campus Martius, was probably supplied with a monumental archway for the Aqueduct from the first: at all events there must have been one after the repairs of A.D. 45-6. But in A.D. 51-2 Claudius decided to commemorate his British triumph, appropriately enough, by spanning the road which led to the newly acquired province by a monumental arch⁶ at this point. The largest fragment of the main inscription,⁷ recording in restrained terms the success of the finely planned expedition of conquest, was found in 1641: *quod reges Britanniae xi devictos sine ulla iactura in deditionem acceperit, gentesque barbaras trans oceanum primus in ditionem populi Romani redegerit*. But further details as to the monument have to be sought in scattered sources, for the Arch was ruined before the ninth century.⁸

Lanciani⁹ considers it probable that part of this Arch was found at the end of the fifteenth century, inasmuch as Fra Giocondo¹⁰ gives a drawing of the base of a pier and a decorated architrave. Excavators had indeed been at work before 1551, when Ligorio wrote the following note.¹¹ 'Now all the spaces

¹ Lanciani, *Not. Scavi*, 1885, 70, 250.

² See Nichols, *Journ. Brit. and Amer. Arch. Soc.* i. 24 ff.

³ Lanciani, *Not. Scavi*, 1887, 447, and *Sched. Vat.* 37, f. 154; Gatti, *Bull. Com.*, 1888, 61, and pl. iii, a good photograph.

⁴ Further details are unfortunately not given.

⁵ *Eins.* 4. 4.

⁶ Hülsen-Jordan, *Top.* i³ p. 468. Whether the arch on the coins (*Cohen*, Claudius, 16-24; *B.M. Cat.* Claudius, 29, 32-5, 49, 50) is this arch is doubtful. They were issued in A.D. 46-7.

⁷ *CIL.* vi, 920-3 = 31203-4 (but not 31273 or 31286).

⁸ e.g. the *Einsiedeln Itinerary* (4. 4) only mentions arches to the left of Via Lata going from Porta Flaminia, and these are broken. The other arch in Via del Nazareno is spoken of as crossing a road. See Lanciani, *Mon. Linc.* i. 427.

⁹ *Storia degli scavi*, iii. 125; cf. *Forma Urbis*, 15 'scavi, 1495'.

¹⁰ *Uffizi*, 125 entitled *Questo basamento fu trovato a piazza detta de Ssara*.

¹¹ *Cod. Taur.* xiv (with the drawing of the arch) = *Ottob.* 3373. 16. 'Ordonque tutti i luoghi signati nell'arco A, B, C, D tutti erano ornati di scultura di figure, ed i luoghi

marked A, B, C, D on the Arch in the drawing (Pl. VIII *b*)¹ were adorned with sculptured figures, and the spaces marked E had inscriptions with the genealogy of the relations of Claudius and his descendants and his offspring.² . . . In our own day we have seen it in a heap of ruins underground, and it has been excavated, and its remains sold to people who have executed other works, and some parts of it have been saved and placed in the house of the Fabii.' These Fabian pieces are unknown, though Aldrovandi³ saw there 'two fragments of large marble slabs with fine sculptures'. The Arch was revealed again in 1562, as an anonymous copyist⁴ tells us; *nella piazza di Sciarra fù ritrovato un'arco di Claudio imp. l'anno 1562 con queste iscrizioni*. And of these discoveries there is a fuller description by Flaminio Vacca, as follows:⁵ 'There were found then, in the time of Pius IV, fragments of the arch of Claudius and many fragments of reliefs with the portrait of Claudius, which were bought by Signor Giovanni Giorgio Cesarino; and they are now in his garden at S. Pietro in Vincoli.⁶ I bought the rest of these fragments and there were 137 cartloads. The whole of the construction was of fine marble: only the base was of Carrara.'⁷ Stuart Jones

signati E erano scritti, dove erano le intitulazioni della genealogia de' parenti di Claudio et della sua discendenza et della sua prole, ma tutte erano malamente trattati i caratteri et dall'antica rovina et da quelli che l'anno cavate da sotto terra' (from Lanciani, *loc. cit.*) *Cod. Ottob.* continues as follows: 'a di nostri l'havemo ueduta in un monte di rovina sotto terra, et cavata, et vendute le sue reliquie a genti che ne hanno fatto altri lavori et alcune cose sono salvate in la casa de' Fabii.'

The inscription *Ti. Claudius Drusi f. Augustus Germanicus Pontifex maximus trib. pot. vii. imp. xi. P.P. Cos. v. Aquae Virginis public(ae) commo(ditati)* (two lines at end illegible) which he shows in the drawing must be rejected as a forgery (*CIL.* vi. 708*) as the dates are inconsistent. Claudius's 7th tribunate was in 47, but his 5th consulate in 51. Whether, however, the measured drawing of the arch can so easily be discarded is quite another affair.

¹ The drawing is repeated twice but very badly in *Barb. lat.* xlix. 35 (= 4426), ff. 43, 54, under the title *disegno dell'arco di Claudio cavato da un libro di Pirro Ligorio che sta appresso la regina di Svezia* (see *JRS* ix (1919), 172).

² He is referring to the inscriptions found in Piazza Sciarra (*CIL.* vi. 921; cf. 31204) but adds two which he himself had invented (*id.* vi. 712*).

³ *Statue di Roma*, 231; not mentioned by Lanciani, *Storia degli scavi*, ii. 160.

⁴ apud Manutium, *Vat. Lat.* 5237. 141.

⁵ *Memorie*, 28.

⁶ Of these sculptures nothing is known: but the series of inscriptions in honour of Germanicus, Drusus the son of Tiberius, Antonia the mother of Claudius, Agrippina, Nero, and Octavia (*CIL.* vi. 921) passed into his possession; a fragment is now in the Capitoline Museum.

⁷ 'Vi furono trovati al tempo di Pio IV dei frammenti dell'arco di Claudio e molti pezzi d'istoria col ritratto di Claudio, che furono comprati dal Sig. Gio. Giorgio Cesarino; ed oggi se trovano nel suo giardino a S. Pietro in Vincoli (cf. *LSS.* iii. 111). Io comprai il resto di detti frammenti e furono cento trentasei carrettate. Tutta l'opera era di marmi gentili; solo l'imbasamento di saligno.' It has been pointed out by Stuart Jones (*PBSR.* iii. 220) that the relief mentioned by Vacca in the next paragraph has no connexion whatever with the arch; and it is indeed undoubtedly identical with the relief representing the reception of an emperor by Roma, now in the Capitol (cf. *Catalogue of the Museo dei Conservatori*, pp. 29 ff., cf. p. 371; *Scala*, ii. 12) which, though the head of the emperor is lost, cannot be earlier than the time of Hadrian, and may belong to the Antonine period.

thinks¹ that three fragments² of sculpture drawn by Pierre Jacques (1572-7) in Piazza Sciarra belonged to these same reliefs. If so, they were not among those acquired by the Cesarini. The first (29), with the legend *in piace dy Sciarra, 1576*, represents a frieze on which is sculptured a combat between Romans and barbarians; below it is an architrave and a griffin's head. On 30, styled *Sciarra, 1577*, is the head of a bearded *signifer*, with lion-skin hood; 63, styled *Sciarra*, is the laureated head of a *tubicen*. The two heads are drawn on a larger scale than the frieze; and it is not improbable that they belonged to figures from large panels.

In 1587 further excavations took place, described by Girolamo Ferrucci:³ 'In this present year 1587, excavations having been made in the Piazza di Sciarra, mentioned by the author in the same place, on the way to the portico of Antinous⁴. . . either to construct aqueducts, or for some other reason, I have seen some large blocks of marble discovered, which showed that there had been some notable antiquities here; but a little later Messer Biagio Stefanonio, a grocer at the corner, told me that in that place many thought there had been the Arch of Claudius Caesar; and he showed me in his own shop the core of one of the piers of this arch made of *peperino*, and that in his cellar there were also some columns of granite.'

In 1641 excavations brought to light the largest fragment of the main inscription of the arch, now in Palazzo Barberini, Rome, and cited above: minor inscriptions to Germanicus, adopted son of Tiberius, and Britannicus, were also discovered.⁵ In addition to these, Cassiano dal Pozzo, in his manuscript diary now at Naples,⁶ states that fragments of bas-reliefs were found at the corner house of Via di Caravita, which stood on a pier of the Arch, and that further excavations produced more belonging to the same series. This is confirmed by Gigli,⁷ who speaks of three discoveries. The inscriptions were found first; then, on 12 November 1641, about 5 m. below the modern pavement, a quantity of marble sculptures and fluted columns of *giallo antico* were found, and part of a column (type and material unstated) was found in making a drain; thirdly, excavations were made by the *Conservatori*.⁸ But these accounts do not enlighten us as to the character of the reliefs, all of which have been lost. The same fate attended the sculptures discovered as recently as 1869, when a house at

¹ PBSR. iii. 2.

² Reinach, *L'Album de Pierre Jacques*, pls. 29, 30, 63.

³ *Antichità di Roma*, p. 115: an Italian translation of Andrea Fulvio's *Antiquitates*.

⁴ The name then given to the Hadrianæum.

⁵ CIL. vi. 920 = 31,203: also 922, 923.

⁶ ap. Lumbroso, *Cassiano dal Pozzo*, 52.

⁷ Cipriano Cipriani, *Relazione ad Urbano VIII* ap. Fea, *Misc.* ii. 252: XXVIII = Schreiber, *Sächs-Ber.*, 1885, 146.

⁸ Gigli, *Memorie*, apud Nibby, *Roma antica*, i. 441, cited by Stuart Jones, PBSR. loc. cit.

the corner of Piazza Sciarra was demolished. These were a large-scale booted leg and youthful head, and a small-scale rider. There were also fragments of fluted columns in *giallo antico* and plain columns of granite, thus confirming Ferrucci and Gigli.¹ Finally, it has been suggested that two fragments, a large-scale helmed warrior with shield and a small-scale prostyle tetrastyle Ionic temple, with pediment filled with an *Amazonomachia*, may belong to the Arch. These were found among rubbish in the Corso, opposite nos. 320 and 259, and are in the Capitoline Museum.²

The aqueduct now continued³ towards the Pantheon. West of Via Lata arches were found in the sixteenth century under the church of S. Nicolas de Forbitoribus, which lay on the line of the Via di Caravita, a little to the east of S. Ignazio.⁴ Vacca records⁵ that 'between the Piazza di Sciarra and the obelisk of S. Macuto lay a little church of S. Antonio,⁶ very old; and wishing to make a tomb in it they discovered great masses of *peperino* blocks. They found so many that they destroyed the old church and built a new one with what they made from the sale of them.'

In front of the church of S. Ignazio, but not quite parallel to it, a monumental aqueduct-arch was found when the church was a-building, as Cassiano dal Pozzo⁷ relates: 'In digging the foundations for the church of S. Ignazio there was found an old water conduit which, as it could not be diverted in any other way, nor dried up so that safe foundations could be made, was turned into a drain which was also ancient, which led towards the Pantheon.⁸ Father Orazio Grassi, a Jesuit of Savona, the architect of this church, took the plan of this aqueduct and gave me a copy.⁹

¹ Lanciani, *Bull. d. Inst.*, 1869, 225; *Bull. Com.*, 1878, 14; Pellegrini, *Bull. d. Inst.*, 1870, 122; cf. p. 179.

² Mancini, *Not. Scav.*, 1925, 230; Bocconi, *Musei Capitolini*, 292. 9; 294. 14; *Year's Work in Class. Stud.*, 1925-6, 112.

³ Stuart-Jones, *PBSR*. iii. 270, identifies with arches at this point the statement of Fulvio, *Antiquitates Urbis Romae* (1527), iv, p. 60 (wrongly numbered 50) 'fuerunt et alii arcus sive fornices quorum duo aetate mea diruti sunt, unus iuxta plateam Sciarrae, via quae ducit ad porticum Antonini Pii, cuius adhuc extant ornamenta quaedam marmorea' (to what marble fragments he refers is uncertain).

⁴ For the exact site see Hülsen, *Chiese*, 397, 398, and pl. ii, *Gl*; Lanciani, *Storia degli scavi*, iii, 125.

⁵ *Mem.* 91 ap. Fea, *Misc.* i. 92; *mem.* 92; ap. Schreiber, *Sächs. Ber.* 1881, 80.

⁶ It had been rededicated to S. Antonio by the Camaldulian monks to whom it belonged.

⁷ Lumbroso, *Cassiano dal Pozzo*, 47 (from the *Memoriale*).

⁸ *Roma antica e moderna* (1653), 161, notes the running water and a statue of Minerva.

⁹ The copy came, with the greater part of Cassiano dal Pozzo's collection of archaeological drawings, to the Royal Library at Windsor Castle (vol. A. 12; Michaelis, xv, f. 44; now *Inv.* 10397). It has the legend 'Pianta di un Aquedotto antico trovato nel fare i fondamenti di S. Ignazio copiata da un disegno del P. Grassi, e del P. Donati' (ibid. f. 45; *Inv.* 10398 is another plan). The hand is that of the copyist who did so much work for Cassiano dal Pozzo—the second hand in the so-called Coner codex, now at the Soane Museum in London, see *PBSR*. vi. 187. There is also a restored elevation (ibid. 46; *Inv.* 10399) and a drawing giving the legends on the two lead pipes (ibid. 47; *Inv.* 10400).

A head was also found which was generally thought to be the portrait of Cicero, and was presented by the Jesuit fathers to Cardinal Ludovisi.' Another Jesuit, Donati, gives a long description of the same remains, with a plan, two elevations and a section:¹ 'I cannot pass over two recent discoveries . . . the second, that an ancient arched aqueduct was found recently under the site of our College at Rome, covered by its own ruins and buried, when the foundations of the church of S. Ignazio were being constructed . . . but much more finely built and more beautiful than the rest, which are built of brick. For the piers were faced with marble slabs on the outside, with antae of Corinthian columns at the side: while the pilasters were a little drawn back (recessed), and were also faced with marble. The epistyles, friezes, and cornices were of marble, and the wall above was faced with marble, while statues stood, I think, on the fluted marble columns. In the interior the piers were strengthened with travertine, with Doric pilasters supporting the epistyle and the cornice. Above these was brickwork, in which the *specus* was carried: it was about 6 palms high, and 3 wide (1.33 × 67 m.). The arches between the piers were faced with marble; and the intercolumniations varied in size.' He also refers to other discoveries, noting that 'In the foundations of the (east) side of the church, considerable remains of private baths were found. There were vaulted furnaces, from which the heat was carried through earthenware pipes into the hypocausts even on a different floor: the rooms were small, not much larger than the height of a man; they were faced with blotched marbles and with Parian; the pavements were of coloured mosaic, with leaves and flowers, such as we saw also on the Aventine. . . . Lead pipes were also found there, one of which bore the inscription *Narcissi Aug(usti) lib(ertus) ab epistul(is)*² and the other *Templo Matidiae*.'

Farther west still, in 1871, other aqueduct-arches were found in the piazza in front of the little church of S. Macuto,³ to the south of Via del Seminario. But the exact point⁴ where the aqueduct ended has not been found. Frontinus' phrase, *arcus . . . finiuntur in Campo Martio secundum frontem Saeptorum*, means that

¹ *Roma vetus ac recens* (1638, ed. i), 292. Lanciani cites Cassio, ii. 374, but he is simply copying Donati's text, just as Piranesi, *Campo Marzio*, pl. 30, and Canina, *Edificii*, iv. pl. 224 (cf. iii. 98) have copied Donati's illustration.

² *CIL*. xv. 7248, 7500. Whether the private baths were contemporary with either of the pipes is uncertain. They may well have been later, for private baths so close to the *Saepta* are not so easy to imagine in the time of Claudius or Trajan as in the time of Severus, when the Marble Plan (HülSEN-Jordan, *Top.* i3, 564, n. 13) shows that part of the space to the west of the *Saepta* was occupied by streets and private houses.

³ Lanciani, 126 : 338; *Bull. d. Inst.*, 1871, 21; *Bull. Com.*, 1878, 17; Parker, *Historical Photographs*, 2326.

⁴ Gatti, *Bull. Com.*, 1888, 66; HülSEN, *Röm. Mitt.*, 1889, 269.

it ended behind the front of the *Saepta*, in the Campus Martius, being perhaps the so-called *campus minor*, bounded by *cippi*.¹ As the length of the arches is given at 700 paces it may be supposed, with Hülsen, that they ended near the Palazzo Serlupi.² We cannot point to remains of a terminal *castellum*. But the primary function of the aqueduct was to supply the Baths of Agrippa, and a discovery made in the time of Donati³ may relate to the delivery-pipe by which they received the water. 'On the right (west side of the church)', he says, 'another huge lead pipe was found 50 palms below the ground level, wide and gaping, like the outside of a large howitzer: nor was it smooth and round on every side, but a little pointed, so that the water could have a wider space to flow in at the bottom. This pipe ran a very long way and its end was not found; and as it was not marked with the maker's name it too may have belonged to the Baths of Narcissus.' Donati's supposition is very unlikely.

¹ *CIL.* vi. 874; Lanciani, *Bull. Com.*, 1883, 11.

² Lanciani, 127: 339, gives to Aqua Virgo a travertine arch found close to Palazzo Serlupi in 1702; but this (*Forma Urbis*, 15) would necessarily have lain on the north side of the Via del Seminario, whereas the aqueduct lies to the south, in front of S. Macuto. Fea (*Acque*, 13) saw 'a long portion' (of the aqueduct) 'in fine brickwork, in the cellar under the great refectory of the fathers of the Minerva'. But this is just as much too far to the south and it is probably what Lanciani marks as *Cloaca*; along the presumable line of the aqueduct he indicates a wall (opposite the 'Scavi Piranesi' in the Palazzo Serlupi). The travertine blocks from Palazzo Serlupi, used in the building of Porto di Ripetta (1704), were probably from the back wall of the Temple of Matidia; see Ashby, *Town-Planning Review*, xii, 245, n. 18; cf. Hülsen, *Oesterreichische Jahreshfte*, xv (1912), 139 and n. 19. They are not from Aqua Virgo.

³ *Roma vetus et recens*, 1639, ed. i, p. 293.

VII. AQUA ALSIETINA

FRONTINUS considered this water so bad that he is moved to discuss it. 'The reason why Augustus, a most provident Emperor, introduced the Aqua Alsietina, called Augusta, is not quite clear to me: it has no good point, being in fact hardly wholesome, and is therefore nowhere served to the public. Possibly on building the Naumachia he brought this water in a special conduit to avoid robbing the more wholesome supplies; and then granted the water which came to be left over from the Naumachia, for adjacent gardens and private irrigation. Yet it is customary in Trastevere, when the bridges are undergoing repair and the water-supply from across the river is cut off, to draw from the Alsietina as may be needed to help out the public fountains. Its source is Lake Alsietinus, six and a half miles along a road branching right at the fourteenth mile of Via Clodia. Its conduit has a total length of 22,172 paces, with 358 paces on arches.'¹ He further notes that 'the lowest of all is the Alsietina, which supplies the Transtiberine region and the especially low-lying districts.'² Again, 'neither the Virgo nor the Appia nor the Alsietina has a receiving reservoir, that is, a settling-tank. . . . The conduit of the Alsietina ends behind the Naumachia, for which it seems to have been made.'³

'The volume of the Alsietina at source is neither set down in the Records, nor could it be accurately determined under present conditions, because it receives from Lake Alsietinus and then from Lake Sabatinus near Careiae, as much as the watermen regulate. It delivers 392 *quinariae*.'⁴

'The Alsietina has 392 *quinariae*. The whole of this is used outside the city, 254 being used by the Emperor, and 138 allotted to private persons.'⁵

The alternative name Aqua Augusta, noted by Frontinus, occurs on a slab of travertine found in 1887, used as a cover upon a modern branch of the Acqua Paola.⁶ The text runs [IMP. CAESAR] | [DIVI F.] AVGVSTVS | [P]ONTIF. MAX. | [FOR]MAM. MENTIS. ATTRIB. | [R]IVO. AQVAE. AVGVSTAE | [Q]VAE. PERVENIT. IN | NEMVS. CAESARVM | [VT] EX. EO. RIVALIBVS. QVI | [AD B]VCCINAM. ACCIPIEB. | (aqua perennis fluere). 'The Emperor Caesar Augustus, Son of the deified Julius, Pontifex Maximus,⁷ added the Channel of Mens⁸ to the conduit of the Aqua

¹ Frontinus, II. 22, 172 paces are equivalent to 32.925 kilometres, and 358 paces to 532 m.

² Id. 18. A statement which requires qualification; for it reaches the Janiculum at 71 m. above sea-level, though the Naumachia was at only 16 m. above sea.

³ Id. 22.

⁴ Frontinus, 71. 392 *quinariae* are equivalent to 16,228 cubic metres in 24 hours.

⁵ Id. 85.

⁶ Barnabei, *Not. scavi*, 1887, 181 ff.; Hülsen, *Röm. Mitt.*, 1889, 289; *CIL*. vi. 31566 = xi. 3772a. The slab measures (as preserved) 63 cm. high, 65 cm. wide: the letters at the last line but one are 4 cm. high, and those of the last 4.5 cm. The branch leaves the main aqueduct WSW. of the railway station of Cesano, between Bracciano and Rome, and runs by Osteria Nuova to Casale di S. Maria di Galera. From Osteria Nuova another branch runs to Procoio del Gallo, near which the slab was found, and into which it is now built.

⁷ Augustus received this title in 12 B.C.; the date is not more precisely given, but the Aqua Alsietina was built for the Naumachia in 2 B.C.; thus, the title would naturally appear.

⁸ Mens was worshipped as a goddess and had a temple on the Capitol: Platner and Ashby, *Top. Dict.* s.v.

Augusta which goes to the Grove of the Caesars, so that from it the water might flow continuously to those consumers who once received water at fixed hours only.¹

According to Mommsen, to whom the restorations are due, the *forma Mentis* would be an aqueduct turned into the Aqua Augusta in order to increase its supply. But this depends upon taking *attrib.* as a participle, for which there is no need in the simpler restoration here adopted.

THE course of the aqueduct from *Lacus Alsietinus*, now Lake Martignano,² has never been determined on the ground; and the author is not only unable to add to what previous investigators believed they had found, but is compelled to reject their conclusions.

The general information given by Frontinus is as follows: First, the Lake was reached by a branch road $6\frac{1}{2}$ miles in length, starting from the fourteenth mile of the Via Clodia. The fourteenth mile is south of S. Isidoro, a *casale* on a hill east of the road, at point 138,³ where Aqua Traiana (now the Acqua Paola) and the railway diverge northwards from Via Clodia. There is no visible *diverticulum* here, though a vanished road may have followed Aqua Traiana northwards, a convenient but undemonstrated hypothesis.⁴ An important road, however, goes northwards just beyond the fifteenth mile, at the modern Osteria Nuova (*ad Careias*), the distance to the Lake being about $5\frac{1}{2}$ miles: accepting this, one would read in Frontinus xv instead of xiv, and v s instead of vi s. Secondly, Frontinus observes that near Careiae, the picturesque village of S. Maria di Galera deserted in 1809, the aqueduct received water from the *Lacus Sabatinus*, now Lake Bracciano; and this shows in a general way the line of country it must have taken. Thirdly, his total length of 22,172 paces shows that it must have run in a fairly direct line.

The average fall to the Janiculum is 45.3 ‰, Lake Martignano being at 207 m.⁵ above sea-level, and the known *specus* on the Janiculum at 71 m. But the greater part of the fall must have occurred in the first portion of its course, as is shown by its relation to Lake Bracciano. This Lake is only 164 m. above

¹ *Ad buccinam* is interpreted by Barnabei, followed by Hülsen, to mean 'at fixed hours by time measurement through a trumpet-shaped pipe or tap'. But the phrase *ad buccinam* was common as meaning 'at a given signal', and it is not necessary that it should refer to anything more than the regulated system in use on the Aqua Crabra (*CIL.* vi. 1261, see p. 46), where certain proprietors received water at definite times.

² The identification is due to Holste (see below) and is certain, as the distance given by Frontinus corresponds; though it is perhaps surprising that the territory of Alsium (the modern Palo) should have extended so far—and there is no other possible reason for the name.

³ See the Italian map, *Carta dell Istituto Geografico Militare*, f. 143, ii. S.E. (Formello 1 : 25,000).

⁴ Volpaia's map does not help us, for it shows no road this way.

⁵ *Carta IGM.* f. 143, ii NO (Anguillara Sabazia).

sea-level, and its outlet, the Arrone, falls at first quite gradually. Its bed is not deep, and the ground-levels adjacent to it are 162 m. at Mola dell'Arrone, about 800 m. from the Lake; 161 m. at about 1,300 m.; 147 m.¹ at the acidulous spring called Acqua Claudia, at about 3,300 m.; 143 m. at 4,300 m.; 141 m. and 139 m. at 5,800 m. and 7,300 m. The last point is at Osteria Nuova, where the Via Clodia crosses the streams. Not lower than this point the supply must have been tapped for the Aqua Alsietina; for the stream now drops rapidly, partly encircling Galera in a deep and most picturesque valley, and in two kilometres, below Cornazzano, the level has dropped to 59 m. These conditions apply whether the stream or the Lake were tapped. Thus, without any attempt to be precise, it is clear that the junction of the supplies must have occurred somewhere in the neighbourhood of points 143 or 141, about half-way between the railway and the Osteria Nuova. The branch, if not the main aqueduct, must also have crossed the Fosso di Cesano, possibly to the south of the Aqua Traiana, as the Alsietina was lower in level. It probably crossed on a bridge, though not very far down the valley. Since remains are absent, it is, indeed, possible that it tunnelled under it, for the north-west end of the bridge of the Acqua Paola is only at 146 m.² above sea-level, and crossed at a low level. At all events, some of the 358 paces on arches are no doubt to be looked for in this valley. After this we can only suppose that it kept underground for most of its course.

This information is largely negative. But positive theory will not stand the test of investigation, as may be shown by an examination of Nibby's view,³ the only coherent one enunciated. He observes that 'in 1826, the mouth of the channel where it passed from the lake was high and dry. . . . Beginning from the *specus*, I followed it . . . for about 600 feet. It is without special form, irregularly cut in a kind of *cappellaccio di peperino*, and is about 3 feet wide and 5 high; and the roughness of the work is such that one would never say that it belonged to the Augustan period. I followed its direction in the Tenuta di Polline, in Valle Contessa, and in the Quarto di S. Saba,⁴ where there are various air-holes,

¹ *Carta IGM.* f. 143, ii SO (S. Maria di Galera).

² *Carta IGM.* f. 143, ii S.E. (Formello).

³ *Analisi*, i. 134; cf. *Schede*, ii. 66 (fin.), 22-5 May 1824: 'the *specus* of the Alsietina, which is dry, is large enough for a man to pass, but is very roughly cut in the rock. It is on the south-south-east: on the north-north-west a magnificent one has been made this year, cut through the rock for a mile, which falls into the Fosso dei Casacci before Polline where it joins the Alsietina Traiana.' The map (*Carta IGM.* f. 143, ii NO: Anguillara Sabazia) shows that it runs NNW. until it is joined by the *emissarium* of the smaller lake at Stracciacappa, which lies to the north: after which it runs SSW. to the Piano dei Falliti, a small extinct crater, furrowed with deep streams, which all discharge into the lake of Bracciano.

⁴ Both these last two localities are to the south of the lake.

or shafts, which show that the aqueduct ran almost straight as far as S. Maria in Celsano.¹ There, remembering the passage of Frontinus . . . I determined to search for the precise point of junction of these aqueducts, and, it being certain that the station of Careiae was at Osteria Nuova, I inquired whether there were underground channels, &c., in the neighbourhood. After much searching I managed at last to find the *specus*, which is the more interesting because, while it fixes the site of Careiae, it shows with what exactitude Frontinus wrote. I went, therefore, into the olive-yard which formerly belonged to the Valdambrini family, a little before reaching Osteria Nuova, and found the channel of which I was in search. Its opening faces south-east, and it is cut in the tufa in an inclined plane, 150 feet long and 70 deep, in a perpendicular line, where it reaches the water-level. At the beginning this channel is lined with a wall of *opus reticulatum*, which has been partly repaired in modern times: both the ancient wall and the natural tufa are lined with very fine *opus signinum*, which is perfectly preserved after a few steps. From the ground outside to the level of the water which fills the channel 90 steps may be counted, partly visible, partly covered with broken fragments and earth: each of them is about a palm (0.22 m.) high, and all are covered with tiles or *opus signinum*. After having followed the ramp for 57 palms (12.80 m.) one meets with a channel on the right, which is at first passable and is about 5 feet high: and this is the channel which let the water from the Lacus Sabatinus into the Alsietina: this too is cut in the tufa. Then one meets a secondary channel on the left which ends above the vault of the channel: and it is by this *specus* that the water comes which is then collected at the bottom of the principal channel.

'Re-entering the ramp, the channel, after about 12 feet, becomes considerably narrower and lower, decreasing from its initial dimensions of 10 by 4 feet to 7 by 2. At the bottom of the channel the water collects which filters through the minor channel mentioned above. Here it seems that the *specus* of the Alsietina cut at right-angles the channel which serves as a staircase, which I believe was made for the water-men, so that they could go and observe the height of the Aqua Alsietina, and, in case it was low, open the sluice of the channel from the Lacus Sabatinus, which fell down by steps, and this was why they were lined with *opus signinum*.

'Leaving this channel, and descending into the adjacent valley, a little before reaching the sheep walk, a little way from the oil-mill, one sees the *specus* of the Aqua Alsietina cut in the tufa,

¹ This sounds as if he was confusing it with the branch of the Acqua Paola called 'Acquedotto di S. Maria di Galera'. (*Carta, cit.*, f. 143, ii SO: S. Maria di Galera.)

accessible to a man, and with lateral *crepidines*. From this point it ran for two miles through the *tenuta* of S. Nicola, and for another two miles that of Porcareccina: and after three more miles it reached that of Maglicinella, and then turned to the left by Villa Pamfili and to the valley between the Villa Spada and the Villa Ottoboni at Sciarra, finally issuing forth on the level of the Naumachia opposite the main door of S. Cosimato.'

These statements sound promising. But at the Lago di Martignano the author has never been able to see the *specus* which Nibby describes. Since he wrote, either the *specus* has been hidden under the water, or the level of the lake has fallen ten feet or so,¹ for there is now a belt of almost flat shore, from which a rock-cut *specus* cannot have started, the rock walls of the crater lying some 50–100 m. (or more) back, and being concealed by brambles to such an extent that, even if the *specus* is still there, it would be impossible to find it. In any case, the passage in his *Schede* shows that it lay on the south-south-east side of the Lake, out of the requisite position. Its purpose and date may alike be treated as doubtful.

The 'oliveto già de' Valdambri' ² is still to be seen, just north-west of the Procoio del Gallo, to the south of Via Clodia, about a kilometre east of the Osteria Nuova. The inclined plane to which Nibby refers still exists³ on high ground about 100 m. from the high road, and in sight of it. It must have led down to the branch from the Acqua Paola to Procoio del Gallo, and have been constructed in connexion with it. At the top, where the passage is about 0.85 m. wide, there is a little *opus reticulatum* with stone quoins, but so badly built as to favour a reconstruction with ancient materials: and it very soon ends, so that it may have been an ancient ruin used by the builders of the Acqua Paola. The rest of the descent presents no traces of antiquity. The few steps

¹ The present outlet of the lake of Martignano, which is on the NNW., bears an inscription reading *Acqua Paola alla presa dell'Acqua Alsietina*. The channel is modern, with shafts which have recently been filled in, and there is a strong current. It is only indicated in the map as running off into the Piano dei Falliti, on which there is no trace of this channel joining the Acqua Paola. But the following inscription of Gregory XVI, built into the Mola dell'Arrone (see p. 185) clearly indicates that he increased the supply of the Acqua Paola by drawing upon the lakes of Martignano and Stracciaccappa. *Gregorius XVI Pontifex Maximus ad tuendam | Aquae Paulae perennitatem casibus officinarum | collis Ianiculi et commoditati oppidanorum | Anguillariae sumptibus coll(egi) pistorum urbis | fluentis subsidiariis ex lacubus Papiriano | et Alsietino subterraneo ductu passuum | MMCCCLXVI derivatis construi | iussit anno MDCCCXXXI*. The inscription is given by Fea, *Storia delle acque*, 334, who also speaks of the work (ibid. 49 ff. 331) as most disadvantageous.

² It was bought from the Valdambri by the Delballo in 1818: Tomassetti, *Campagna romana*, iii. 43.

³ Holste, *ad Cluv.* 524, l. 40, had been here and maintained that the outlet of the aqueduct still existed, with waters discharging to the Cremera near the Osteria dell'Isola: but this is wrong, for the water runs quite differently.

which can be seen look modern. At the lowest point, farther than Nibby seems to have reached, the *specus* widens out again to its former dimensions of 1.15 m. wide. There seems no doubt that the whole arrangement has nothing to do with the Aqua Alsietina, but only with the above-mentioned branch of Acqua Paola. About 50 m. south there is another shaft, described to us as about 30 m. deep, with earth at the bottom and having no communication with any channel. Finally, whatever the nature of the various channels at Procoio del Gallo, the levels on the modern maps, which Nibby could not have ascertained without a great deal of accurate and laborious observation,¹ are a fatal obstacle to his identification. His channel is clearly shown on the extreme eastern edge of the S. Maria di Galera sheet; it runs along the west side of the nameless west tributary of the Galera for some 2½ kilometres, tunnels under the Riserva Nuova, and finally ends at Fontanile Mezzaluna, east of Casale S. Giacomo. A kilometre farther upstream there is recorded a ground-level of 70 m. But it is quite inconceivable that, while the Aqua Traiana hereabouts keeps at about 145 m. above sea-level, the Alsietina, arriving at the Janiculum only 2.71 m. below it, should have taken this course among the difficult and deep ravines to the south and south-west of Via Clodia. It would have been obliged to cross them on arches, whose total disappearance could hardly be postulated. Further, the ground-levels along the valley of the Galera, which runs just east of the Casale Porcareccina, range from 50 m. near the Casale itself to 36 m. two kilometres to the south of it, and 57 m. three kilometres to the north of it; and this would demand substructures far longer than the account of Frontinus allows. Thus, Nibby's course must be rejected as impossible, although we cannot substitute more than a general line, based upon levels, in its place.

In the City the *specus* of Aqua Alsietina was discovered in 1927, south of the Aqua Traiana and at a considerably lower level, about 71 m. above sea.² It was on the north-west side of Viale XXX Aprile, running south-east. About 1.50 m. of the channel was exposed: it was 0.87 m. wide and the side walls were 0.57 m. thick. They were in concrete faced with *opus reticulatum*. The height as preserved was 1.17 m.; the cubes of the top course were cut off in a triangular shape, so that the *specus* was thought to have been roofed with slabs of stone, but it was more probably vaulted.

¹ *Lanciani*, 131: 343 is perhaps not unfair to Nibby in supposing that the line was mainly drawn *a priori*; the former did not apparently visit the Procoio del Gallo, though he explored (in May 1877) the Tenuta di S. Maria di Celsano and the neighbourhood of Careiae, without finding any traces.

² Van Buren and Stevens, *Mem. Am. Acad.* vi (1927), 137-46.

The discovery renders it necessary to abandon the identification of its terminal *castellum* with the remains described by Pietro Santi Bartoli early in the eighteenth century.¹ He notes that 'alla Longara nel declivio del Gianicolo, sotto dove sermoneggiano li padri della Chiesa Nuova nel mese di maggio,² in tempo di Innocenzo X (1644-55) furono trovati tre grandi stanzoni, quali servivano da ricettacolo di un acquedotto cavato nel monte tutto opera reticolata, quale si vede essere del tempo della repubblica. Avanti le dette stanze vi era un'officina da fuoco rotonda, entro divisa in archetti con li suoi sfogatori al disopra, che forse poteva servire per ceso di stufa. Più sotto, alle radici del monte si trovano di simili edifizii medesimamente reticolati, con quantità di cunicoli nelli quali ancora corre l'acqua.' The second sentence, omitted by Hülsen,³ who had proposed this identification, seems to show that we are dealing with a reservoir connected with a set of baths, to which this heating chamber belonged. It would seem that the Naumachia must be placed, as Lanciani placed it, near S. Cosimato. The Nemus Caesarum was simply a grove surrounding it, laid out by Augustus in honour of Gaius and Lucius Caesar;⁴ and here, as the inscription of the Forma Mentis shows,⁵ lay the terminal *castellum*.

¹ *Mem.* 58 ap. Fea, *Misc.* i. 237; the text in *Roma antica e moderna* (1741), i. 313, is identical.

² The place is fixed in Nolli's plan (f. 18, no. 1229) and in Lanciani, *Forma Urbis*, 19, as Hülsen remarks: and the little theatre built in brick, in which S. Filippo Neri used to lecture, is still to be seen on the Janiculum close to Tasso's oak, at the foot of which is an inscription, set up in 1898, relating how S. Filippo Neri would join in the boys' games; *tra liete gride si faceva co' fanciulli fanciullo sapientemente*.

³ Venuti (*Roma antica*, ii. 189), who quotes the whole passage, does not seem to have seen the objection; nor does Lanciani, 131 : 343, though he rightly explains it as a hypocaust with heating channels (*caloriferi*). The nature of the circular heating chamber may be explained by a comparison with those described in *PBSR.* i. 236 fin. (Via Labicana), and *Not. Scavi*, 1922, 239, 241, 1 (Villa of Hadrian).

⁴ *Mon. Anc.* iv. 43, *navalis proeli spectaculum populo dedi trans Tiberim, in quo loco nunc nemus est Caesarum*.

⁵ *riuvo Aquae Augustae quae pervenit in Nemus Caesarum*; see p. 183.

VIII. AQUA CLAUDIA

FRONTINUS gives the following information about Aqua Claudia:¹ 'After Augustus and Agrippa, Gaius Caesar,² the successor of Tiberius, finding seven aqueducts hardly sufficient for both public needs and private pleasures, began two more³ in the second year of his reign,⁴ in the consulate of M. Aquila Julianus and P. Nonius Asprenas, A.U.C. 791. This work Claudius most magnificently finished⁵ and dedicated in the consulship of Sulla and Titianus⁶ on the first of August,⁷ A.U.C. 803.⁸ One supply, from the Caerulean and Curtian springs, was called the Claudia; and this comes nearest the Marcia in excellence. The other came to be called the Anio Novus, to distinguish more readily the two Anio supplies which had now begun to flow into the City, the earlier Anio being called Vetus.'

'The head-source of the Claudia is on a by-road from Via Sublacensis at the thirty-eighth milestone, within 300 paces to the left.⁹ The water comes from two very copious and beautiful springs, the Caerulean, so designated from its blue appearance, and the Curtian. It also receives the spring called Albulinus,¹⁰ which is of such excellence that when the Marcia needs supplementing, this water answers the purpose so well that its addition makes no change in the quality of the Marcia. Aqua Augusta was also turned into the Claudia, because it was evident that the Marcia was of sufficient volume in itself; though the Augusta still remained a reserve for the Marcia, on the understanding that it should serve the Claudia only when the Marcia would not take it.'

'The conduit of the Claudia has a length of 46,406 paces, of which 36,230 are in a subterranean channel and 10,176 on structures above ground: of these last there are arched works at various points in the upper course of the aqueduct amounting to 3,076 paces, while near the City, from the seventh mile, 604 paces are on substructures and 6,491 on arches.'¹¹

'The Claudia was the second highest in level; while it and the Anio Novus are carried together from their catchbasins on lofty arches, the Anio being above. Their arches end behind the gardens of Pallas, whence they are carried in pipes for the use of the city.'¹²

'The Claudia, being more abundant than the others, is especially exposed

¹ *Frontinus*, 13-14.

² Cf. *Aur. Vict., Epit. de Caes.*, iv. 6 (under Caligula) *aqua Claudia Romae introducta*.

³ *Suetonius, Gaius*, 21, *incohavit aquaeductum regione Tiburti*, is vague. ⁴ A.D. 38.

⁵ The cost of the two was 350,000,000 *sesterces* (£3,500,000 sterling) according to *Plin. N.H.* xxxvi. 122, who (inaccurately) speaks of both aqueducts as originating at the 40th milestone from Rome: 'Vicit antecedentes aquarum ductus novissimum impendium operis incohata a Gaio Caesare, et peracta a Claudio. Quippe a lapide quadragesimo ad eam excelsitatem, ut in omnes urbis montes levarentur, influxere Curtius atque Caeruleus fontes et Anio Novus. Erogatum in id opus *HS. MMMD.*'; cf. *Suetonius, Claud.* 20. Another reading in Pliny gives 55,000,000 *sesterces*. This is perhaps more likely.—ED.

⁶ A.D. 52.

⁷ The birthday of Claudius.

⁸ A.D. 50 (probably a mistake).

⁹ And therefore only about 100 paces from those of Aqua Marcia.

¹⁰ *Suetonius, Claud.* 20 confuses this with the Curtius: 'Claudiae aquae gelidos et uberes fontes, quorum alteri Caeruleo, alteri Curtio et Albulino nomen est, simulque rivum Anienis novi lapideo opere in urbem perduxit divisitque in plurimos et ornatissimos lacus.'

¹¹ *Frontinus*, 18.

¹² *Ibid.* 20.

to depredation. In the Records it has only 2,855 *quinariae*, while I found at the source 4,607 *quinariae*—1,752 more than in the records. Our gauging is rendered the more trustworthy by the fact that, at the seventh milestone from the City, at the settling-tank, where the gauging cannot be questioned, we find 3,312 *quinariae*, 457 more than in the Records; yet not only are grants made before reaching the reservoir, but also, as we detected, a great deal is taken secretly, and therefore 1,295 *quinariae* less are found than there really ought to be. Moreover, in the delivery also there is manifest fraud, for the amount actually delivered agrees neither with the Records nor with our gaugings either at the intake or even at the settling-tanks, after so many depredations. For only 1,750 *quinariae* are delivered, 1,105 less than the computation of the Records; but less than the gauging at the intake by 2,857 *quinariae*; and even less than at the reservoir by 1,562. This was why, after reaching the City, pure in its own conduit, it was there mixed with the Anio Novus, so that the confusion might obscure both their volume at the intake and their distribution. If it be thought that I exaggerate the measure of water received, it may be remembered that the Curtian and Caerulean springs of the Aqua Claudia are so well able to supply their conduit with the 4,607 *quinariae* which I have indicated, that 1,600 more are allowed to overflow. I do not deny, however, that this superabundance does not really belong to these springs; it comes from the Augusta, which was contrived to supplement the Marcia, but when not required is added to the supplies of the Claudia, though not even the Claudian conduit can carry all the water.¹

The contemporary inscription of Claudius, on the Arch over the diverging Viae Labicana and Praenestina, later the Porta Praenestina and now the Porta Maggiore, runs as follows: *Ti[berius] Claudius Drusi F(ilius) Caesar Augustus Germanicus pontif(ex) maxim(us) | tribunicia potestate XII co(n)s(ul) V imperator XXVII pater patriae | aquas Claudiam ex fontibus qui vocabantur Caeruleus et Curtius a milliario XXXXV | item Anienem novam a milliario LXII sua impensa in urbem perducendas curavit.*² Its date lies between 25 January A.D. 52 and 24 January A.D. 53. Tacitus³ states that in A.D. 47, *Claudius fontesque aquarum Simbruinis collibus deductos urbi intulit*. This is generally taken to mean that Claudius then actively took up the unfinished work of Gaius, completing it five years later. But the words point to a completion of some sort; and Furneaux⁴ supposed that in A.D. 47 the Aqua Claudia⁵ was in some way brought into Rome. This theory fits *fontesque*

¹ Ibid. 72.

² CIL. vi. 1256.

³ Ann. xi. 13.

⁴ Furneaux, ad loc., vol. ii, p. 173.

⁵ Krohn has suggested (Teubner text, p. vii) that a painting in the house of SS. John and Paul, on the Caelian, may represent Claudius and his aqueduct. 'On the left,' he says, 'we see three arches, and a river-god reclining upon them shows that an aqueduct is represented: while in the centre an Emperor appears to be shown in the act of presenting water to the goddess Roma. Failing objections, I should be inclined to think of Claudius, and I very much hope that the question will be decided by competent scholars.' The decisive objection is that the wall which carries the painting is considerably later than Claudius. Further, the central figure is very unlike him, while the scantily-draped female has no resemblance to the conventional goddess Roma. Finally, the arches on which the river-god, with vase, reclines are in the midst of water, as their reflection shows. Thus, the idea may be rejected. For other interpretations see Amelung, *Diss. Acc. Pont.* 2. x. 206; cf. Strong, *Art in Ancient Rome*, ii. 129, and Lugli, *Classical Monuments of Ancient Rome*, i. 208.

aquarum, which refer to the Claudia, drawn from springs, rather than to the Anio Novus, taken from the river: it would also explain why, when the arches and *specus* of Aqua Claudia were built of ashlar, the *specus* of Anio Novus was built in concrete; for the Anio Novus would, on this view, be added a year or two later. Constructionally, the afterthought was unsound, as was realized by Frontinus. He also hints that Claudius did not receive good value for the great sums which he expended, as Pliny tells us, on the construction of the two aqueducts.

It seems, indeed, almost incredible that the supply should have failed after only ten years' use and been interrupted for nine years more before it was repaired by Vespasian in A.D. 71. Yet this is what the second inscription on the same Arch records, reading *Imp(erator) Caesar Vespasianus August(us) Pontif(ex) Max(imus) trib(unicia) pot(estate) ii imp(erator) vi co(n)s(ul) iii desig(natus) iii p(ater) p(atriciae) | aquas Curtiam et Caeruleam perductas a Divo Claudio et postea intermissas dilapsasque | per annos novem sua impensa urbi restituit.*¹

Nor did these repairs suffice. Ten years later, Vespasian's son, Titus, was to set up a third inscription: *Imp(erator) T(itus) Caesar Divi F(ilius) Vespasianus Augustus Pontifex Maximus tribunic(ia) | potestate x imperator xvii pater patriae censor co(n)s(ul) viii | aquas Curtiam et Caeruleam perductas a divo Claudio et postea | a divo Vespasiano patre suo urbi restitutas cum a capite aquarum a solo vetustate dilapsae essent nova forma reducendas sua impensa curavit.*²

For the work done by Titus there is a good deal of evidence in the remains themselves; but the condition of the aqueduct was still unsatisfactory: in A.D. 88, L. Paquedius Festus, contractor for Imperial and Public Works, restored the ruined temple of Bona Dea, because by her help he had successfully completed the channel of the Aqua Claudia Augusta below the Mons Aeffanus³ on July 3rd of that year. The nature of this work is uncertain.

There is no later record of actual restorations, though the remains themselves show repairs by Hadrian, Severus, and Diocletian.

A constitution of Arcadius and Honorius, dated 8 November 402, threatened very heavy penalties to any one who should injure the Aqua Claudia.⁴ A century later, Cassiodorus, who speaks of the Aqua Virgo with

¹ CIL. vi. 1257. Vespasian was *cos. desig. iiiii* in March, 71 and *trib. pot. iii* in July.

² Ibid. 1258. The date is between 1 July, 80 and 1 July, 81. *vetustate* has no reference to the actual age of the structure: it means, as regularly in building-inscriptions, that the life of the part replaced was finished: it is thus a transferred sense of *vetustas*.

³ CIL. xiv. 3560, *Bonae deae sanctissimae caelesti L. Paquedius Festus redemptor operum Caesar(is) et publicorum aedem dirutam refecit quod adiutorio eius rivom aquae Claudiae August(ae) sub monte Aeflano consummavit, imp(eratore) Domit(iano) Caesar(e) Aug(usto) Germ(anico) xiii co(n)s(ule) v. non(is) iul(iis)*. The inscription is said to have fallen from or to have been found on the summit of Monte S. Angelo in Arcese, a lofty hill which lies west of the aqueduct; on the summit are remains of a medieval church and convent, into which have been built what may be fragments of the temple. Part of the stone is in Palazzo Barberini at Rome, the rest being lost: its provenience is not certain, for it was at S. Gregorio when first copied, in or about 1600. See *PBSR*. iii. 135.

⁴ 'ne quis Claudiam interruptis formae lateribus adque perfossis sibi fraude elicit existimet vindicandam. Si quis contra fecerit, earum protinus aedium et locorum amissione multetur. Officium praeterea, cuius ad sollicitudinem operis huius custodia pertinebit, hac poena constringimus, ut tot librarum auri inlatione multetur, quot uncias Claudia nostrae conniventia eius usurpatas fuisse constiterit.' *Cod. Theod.* xv, 2, 2.

praise, reserves his highest commendation for the engineering of the Claudia, which he considers a greater boon than the Nile; for the Nile flooded low ground in season only, whereas the aqueduct gave a never-failing supply to the high hills.¹

The questions connected with the relation of the length of the aqueduct, in relation to Frontinus, the inscription on Porta Maggiore and the actual distance computed from maps, cannot be separated from an examination of the same problems in regard to the Anio Novus. Both aqueducts are dealt with together in a later context.²

(a) *From the Springs to S. Cosimato. Map 7.*

REVILLAS³ describes remains of baths and other ruins on the left, closer to the first Serena than the modern road, and partly destroyed in widening it. He attributes these to the *caput aquae*, considering them to be vaulted cisterns: but what he saw is uncertain, perhaps no more than the remains of a villa, which the author has noted there in the past.

The *specus* discovered hereabouts have been described above in dealing with Aqua Marcia, to which most may be attributed. On the other hand, the first, second, and third of the *specus* described by Lanciani near La Moletta cannot have belonged to Aqua Marcia, from their level, and it is not unreasonable to assign these to Aqua Claudia. This takes us to the bridge crossing the Anio to Anticoli.

About two miles farther on, near km. 50 on the modern road, the channel of an aqueduct was found, we were told, in tunnelling above the high road. This would have belonged to Aqua Claudia; and so would the *specus* seen by Fabretti and Gori⁵ inside the Osteria della Spiaggia, and recently found to the west of it during the tunnelling operations. It is said to have been built of brick.

Ingegnere Marella informed the author that a third piece of the *specus* was found at the south-west end of the curved road, south-west of Cineto Romano railway station; the place is called Il Ceraso. This, however, may belong to Aqua Marcia⁶.

The Aqua Claudia was brought to light when the railway was made in the 'eighties, in a cutting about a kilometre SSW. of this

¹ *Var.* vii. 6; 'Claudiam per tantam fastigii molem sic ad Aventini caput esse perductam, ut, cum ibi ex alto lapsa ceciderit, cacumen illud excelsum quasi imam vallem irrigare videatur. Aegyptius Nilus certis temporibus crescens per campos iacentes superducto diluvio aere sereno turbulentus exaestuatur: sed quanto pulchrius est Claudiam Romanam per tot siccis montium summitates lavacris ac domibus liquores purissimos fistularum uberibus emississe et ita aequaliter fluere, ut numquam se possit desiderata subducere.'

² *Infra*, p. 253.

⁴ *Lanciani*, 68 : 280; cf. *supra*, p. 98.

⁵ *Aqua Marcia*, 72.

³ *Vat. Lat.* 9024, f. 84.

⁶ *supra*, p. 100.

same railway station, 100 m. to the south of a *casello*, once numbered 56.257. The original vault appears on the north side of the cutting, with a rounded top set on planks; on the south the vault is restored gablewise, also on planks. The *specus* is 1.31 m. wide internally excluding the cement lining; the bottom was probably 1.80 m. below the springing of the vault, ground-level coming now at 1.40 m.: the vault is 1.20 m. high. The coarse concrete of the exterior of the *specus* may then be seen on the north side of the line, running first north-west and then west-north-west. The extrados was levelled at 314.51 m. (II. 40). Allowing 0.50 m. for the thickness of the vault, we may put the bottom of the piece in the cutting at about 311 m.

After this the aqueduct turns a little more to the north; but must soon have turned to the west again, for further traces of its brick channel, much destroyed, and now gone, were seen in 1900 just west of *casello* 55.349, due east of the village of Mandela; and at the point where the railway runs closest to the river, between the railway and the high road, north-east of *casello* 54.480, it ran side by side with Aqua Marcia, being faced in *opus mixtum*.¹

A sector 432 m. long was found in 1866, while making the modern Acqua Marcia, running parallel to the end of the long piece of the ancient Aqua Marcia, described by Lanciani, and about 28 m. from it. It crossed the Cantalupo (Mandela) road at 80 m. from its junction with Via Valeria, but is not now visible. In 1928 part of the *specus* was brought to light at the modern 46 km. stone, immediately before reaching the modern road-bridge over Torrente Licenza. It lay above the road and about 5 m. north-west of it, to the north-west also of the channel of the Aqua Marcia (III. 34). It is a piece of hill-side channel, unfaced, lined with post-Severan brickwork and 0.95 m. to 1 m. wide. At the bottom of the *specus* were two tiles, 0.56 m. square and 0.04 m. thick.

The course of the aqueduct may be followed round the hill to the north-west, and a piece of the *specus*-wall may be seen, faced internally with rough stonework and 0.50 m. thick.

After crossing the path which leads up to Mandela from the north-east bank of Torrente Licenza, a portion of the *specus*, lined with *opus mixtum* of very late date, may be seen on the hill to the north of the mill situated on this stream, running south by west. The rounded vault, set on planks, is 0.60 m. high and 0.60 m. thick (II. 39). It is probable, however, that the aqueduct originally passed close by the mill, for here, while levelling in 1915, we saw

¹ Revillas notes traces of the aqueduct under the Colle dei Cardi and near the Osteria delle Frattocchie, where it is seen on the left for a long way, and then on the right: he is probably referring to these remains (cf. *supra*, p. 100).

ashlar going 20° E. of N., with cement on the west side of it. Three courses were measured as 0.40, 0.25, 0.29 m. high (from the top) and a level of 299.78 m. was taken on the top block. There was also fallen brickwork. But the masses of concrete farther on probably belong to a mill-dam; they have no ancient characteristic, and lie too far upstream for the line of the aqueduct. On the right bank there is no trace at all.¹

The Aqua Claudia is cut by the railway west of *casello* 53.222, at the upper mouth of the tunnel under S. Cosimato. It is 0.84 m. wide, lined with original concrete, rock-cut, running 35° E. of N. A flat intrados on the north side of the cutting is at 300.51 m.; a pointed roof on the south side is at 300.48 m. (II. 38). The concrete walls are 0.38 m. thick. Traces of the external concrete of the *specus* are to be seen on the wooded bank, about 100 m., before the actual gorge begins. They seem to belong to a reinforcing wall below the *specus*, which was probably not exposed. Some 50 m. farther on is a circular *puteus*, which may be original. In the gorge the *specus*, 1.80 m. high and 1.05 m. wide, is hewn in the rock, as is that of the Marcia. At the extreme point accessible (α) it is blocked by earth fallen from above, perhaps from a *puteus*. After 28 m. the *specus* reaches the sluice-tower, the lower part of which has been already described.²

The small sketch plan (Fig. 7) will show the arrangement of the upper part. There is a travertine threshold 0.13 m. high, behind which a pair of slots for a sluice gate was established, and farther behind after an interval, another pair. These were placed in blocks of travertine, the intervals being filled with brick facing. Beyond the second sluice gate comes the vertical shaft, surrounded by brick-faced concrete a metre thick, descending to the Aqua Marcia, whose floor is 9.20 m. below.

Almost immediately after this the channel was blocked by a fall of rock at β , and an alternative channel³ was hewn farther in, and linked at points λ and δ by cross-passages, both now closed by walls of uncertain date, that at δ being 0.95 m. thick. Evidently the repairers attempted to use as much as possible of the original *specus*; but, after a further collapse at ϵ , the whole sector was abandoned.

There follow three windows⁴ in the *specus*; and between the second pair there is a blocked aperture suggesting that the channel originally ran farther out. A *puteus*, some 7 m. behind

¹ An unknown correspondent of Revillas (*cod. cit.*, p. 85) notes here 'accanto alla strada sublacense, dall'una parte e dall'altra di essa Licenza si vedono le sostruzioni d'un'acquedotto [the Claudia] e nella strada medesima i vestigi d'un altro, come altresì nel medesimo fiume vari pezzi diroccati'.

³ It has an almost flat roof, and is 1.50 m. high and 1.05 m. wide.

⁴ See the remarks on a similar opening in the Marcia (*supra*, p. 103).

² *Supra*, p. 102.

the rock-face, is cut through what was probably a construction-tunnel. The *specus* then winds deep into the cliff, but soon emerges with yet another window. The next window is modern, but a little way beyond it an ancient one is accessible by a shaft with footholes from the cliff above. Beyond the next shaft, which lies just above the modern dam and its sluices, the *specus* is blocked for a considerable distance by a fall of stones and earth. It is blocked by a modern wall, and at σ there is a modern door, where the bottom was levelled at 294.84 m. (II. 37: Fig. 16). Just beyond the twist, at π , there are traces of a shaft.

(b) *The Hadrianic loop-line at S. Cosimato. Map 7.*

Eighteen metres beyond π , at ρ , a lateral breach was made in order to insert a pair of sluices leading into a branch channel, while the main channel was also controlled by sluices, at σ . They were worked from a square *puteus*, faced with good *opus reticulatum*, placed over the breach: but a recent wall has blocked this portion of the *specus* (Pl. IX a). Yet another pair of sluices was worked from *puteus* τ , faced with later brickwork; and here was taken the level 293.51 (II. D, l).

The loop now runs rapidly downhill; its walls have disappeared almost entirely—they were 0.90 m. thick and of concrete faced with *opus reticulatum* and brick—but the bottom is preserved. At a distance of 10.90 m. from level 293.51 the bottom was levelled again as 291.14 m., giving a fall of 2.37 m. or 1 in 4.6 or 217.4 per 1,000.¹ Another point was levelled at 290.23 m.; while the end of the slope (Pl. IX b), behind a shrine of the Madonnella, is at 288.03 (II. 36), giving a further fall of 3.11 m. in 8.60. The total length of the slope is 19.50 m., all in a straight line: the fall is 5.48 m. in 19.50 m., 1 in 3.56 or 281.00 per 1,000.²

Lanciani underestimates the height considerably, giving the altitude as only 262 m. above sea-level. The construction of the bridge, now to be described, shows that this loop-channel was made in the time of Hadrian: whereas the account in *Livellazione* reverses the real state of things, marking the main line, on the north bank, as a branch. The truth, as to there having been a branch at all, was indicated on his map of the aqueducts by Revillas, who³ gives a remarkably good description of the whole arrangement, which has not been observed by any one else.⁴

¹ In *Livellazione*, 76, the fall between II. 37 and II. 36 is given as 136.2 per 1,000, the difference being 294.84–288.03 = 6.81, and the horizontal distance being estimated at 50 m. But the main fall occurs in the last 20 m.

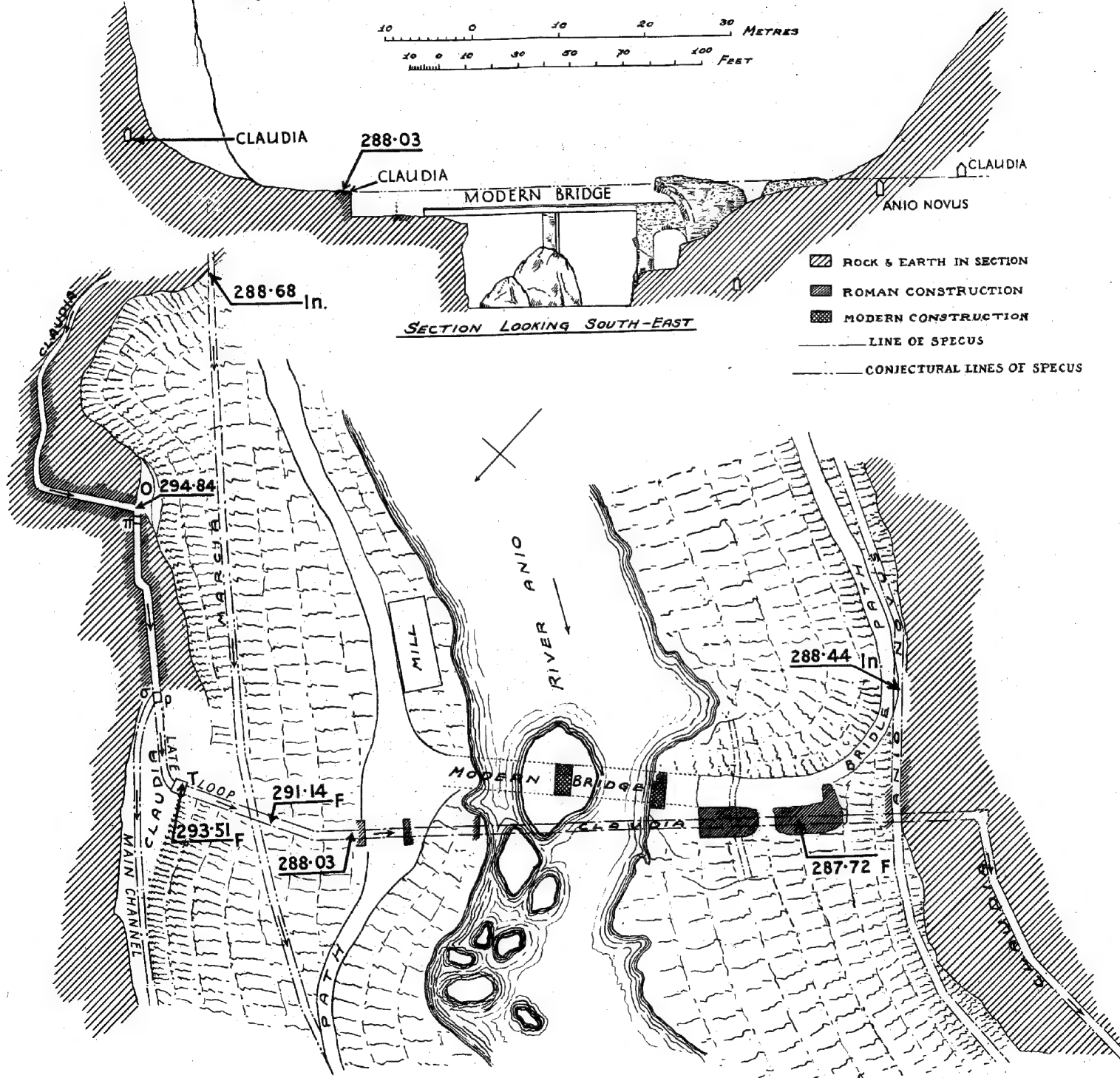
² Below the path is *caposaldo* 233 (282.14).

³ *Vat. Lat.* 9024, ff. 86^v, 87.

⁴ He is indeed wrongly criticized by Cassio, i. 101.

FIG. 16

HADRIANIC LOOP OF AQUA CLAUDIA AT GORGE OF S. COSIMATO



Canina,¹ on the other hand, misunderstands the bridge completely, giving it two tiers of arches and attributing it to the Marcia. From his sketch of the actual state, however, it would seem that the pier on the north bank was better preserved in his time than at present; and this is corroborated by the representation of it by J. P. Hackert, who painted the same scene in 1780.² This pier at present has the shrine already mentioned built against it. It is 2.95 m. wide, and, like the rest of the bridge, is faced with good brickwork and *opus reticulatum*, assigned by Dr. Van Deman to Hadrian; there is also some reinforcement in later brick-faced concrete. From the remains of piers shown in the plan (Fig. 16) there were probably two small arches on the north bank: while in the stream itself there were probably two larger arches, supported on the rock which now carries the foot-bridge. On the³ south bank are remains of a pier, of a part of its arch, with tile voussoirs still appearing, and of a certain amount of concrete substructure, running for a length of some 16 m. in all. Here the bottom of the *specus* was levelled at 287.72 m.

The branch now turns at right angles⁴ and follows the hill-side: at the turn there was the usual square shaft, noted by the author before 1913, but never visible since then. The bank of the stream was here reinforced by a large mass of concrete, faced with *opus reticulatum* with bands of brick and small blocks in alternate courses. This was intended to prevent a collapse of the *specus* of the Anio Novus (Fig. 16), and may also be attributed to Hadrian.⁵

¹ vi. 141 (cf. v. 141); *Lanciani*, 77 : 289, follows him in this, and also in believing, as he states in his text, that remains of an earlier ashlar structure were enclosed in the concrete.

² An engraving after this picture figures as no. iii in a series of ten views, with a map, depicting the neighbourhood of Horace's Sabine farm, dedicated by Hackert himself to Gustavus III of Sweden.

³ Cassio, loc. cit., would seem to be referring to something rather higher upstream: 'gran ponte di cui al presente (secondo la relazione avuta dal P. Gio. Maria di Roma, Guardiano di quel convento) quando quel fiume va scarso d'acqua si scopre un gran masso arcuato, che ruinando formò per accidente un'Argine, qual servi poscia ai Vicovaresi per votare l'acqua alle lor Mole, e vi edificarono un piccolo ponte di passaggio al molino.'

⁴ The brick side of a *specus* visible in the path must belong to the Anio Novus, here lowered in level, so as to allow the Claudia to pass over it (see p. 262).

⁵ According to Dr. Van Deman. Revillas (*Vat. Lat.* cit.) explained these remains erroneously. Believing that the Marcia had already crossed the Anio far higher up, he supposed that the bridge carried a secondary channel linking the Claudia to the Marcia, and that the *specus* of the Marcia in the gorge was of much later date. The *specus* of the Claudia in the gorge of S. Cosimato was noted by Montfaucon (*Itin. Ital.* 339) and Volpi (*Vetus Latium*, x. 2. 465: he says he saw two, one above the other, and attributes them to the Claudia and Anio Novus) and described by Cassio (i. 14. 70; cf. the map opp. p. 1: the passage quoted in *Lanciani*, 76: 188 as to the deposit of the Marcia is from this latter place) who measured the opening at the west end as 6½ by 4½ palms (1.50 by 1.00 m.). He attributed both channels to the Marcia, and believed the water to have come from the Fucine Lake. He attributes to its *specus* shafts observed for him by Count Venetini, in the lands of Tagliacozzo and

Various traces of the branch have been found farther downstream, all dated to Hadrian or later. Below the path, in a garden situated just before the mouth of the first tunnel below the dam, part of the *specus*, a late restoration, 0.70 m. wide, was seen. Again, to the SSE. of the cemetery of Vicovaro (whose chapel is indicated as S. Maria on the map) and not far below I. 61, a small concrete supporting arch, with a buttress faced in *opus reticulatum*, was noted. The bottom of the *specus* was here levelled conjecturally at 281.70 m. (not in *Livellazione*), and has now been destroyed by the power conduit. A little farther on, at the east end of the concrete bridge by which this conduit crosses a little tributary of the Anio, south of the cemetery and railway bridge over the river, the *specus* was found. It was in 'cut-and-cover' work: the flat concrete top of the exterior was 2.47 m. across, the roof was 0.59 m. thick (II. 35). It is now destroyed: but the remains of a small bridge across the tributary may still be seen, in concrete faced with reticulate work and brick; it was no less than 8.20 m. in total width; the arch, 2.50 m. in span, is now blocked with earth.¹

A little farther on, excavation for the conduit destroyed part of an aqueduct whose level and construction assigns it to this branch of the Claudia. It was 0.90 m. wide, with a pointed roof, whose intrados was about 0.75 m. above the bottom of the conduit. A rectangular rock-cut shaft of the same width lies close to *casello* 51.333,² some 20 m. from the railway and 10 m. above it.

The same *specus* was found, again while building the power-conduit, in the little valley east of *casello* 50.798, where a path runs up from the road just downstream of Vicovaro bridge to the station (II. 34). All that is now visible³ is a portion of the *specus* walls, entirely of rough concrete, under and beside (SSE. of) the bridge which carries the power-conduit over this little valley: the *specus* is full of earth. Here the branch rejoins the main channel.

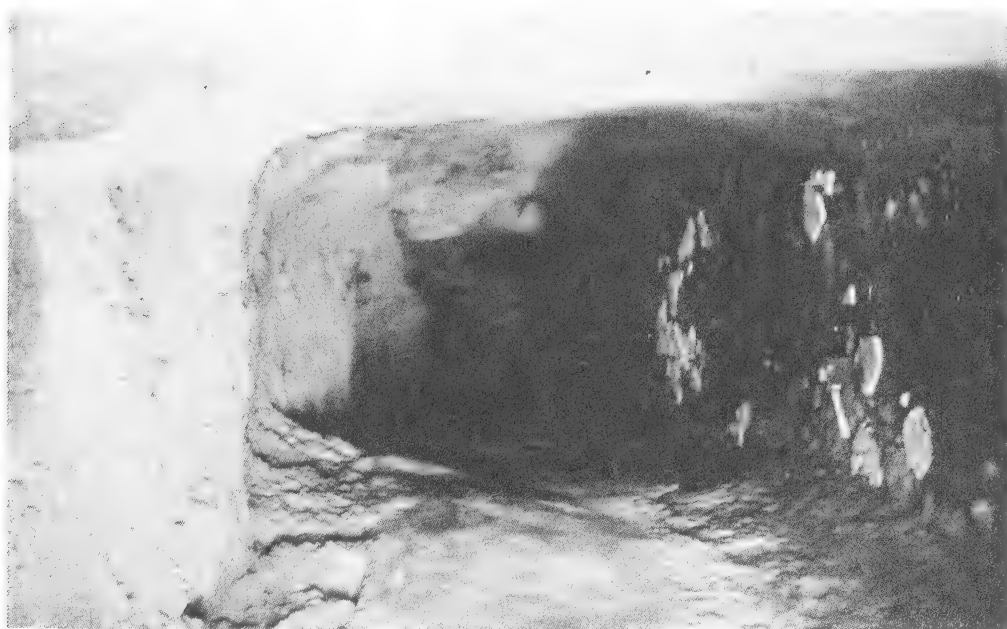
Pereto; this is wrong, but their real meaning is unknown. Other shafts noted by him ($\frac{1}{4}$ mile from Palazzo Massimo at Arsoli; near Cineto; near Cantalupo (Mandela); above Via Valeria, north of Cineto, at Le Serre) are probably natural fissures. His fantastic idea that these represented the original conduit of Ancus Martius leads him to give the east sector to the original conduit, and the west to the later Marcia. His statements (i. 102) that Volpi thought that they were running one above the other, and not side by side (whereas, as Padre Guardiano assured him, this depended on the point of view) and that the east end was inaccessible, seem to the author to show quite clearly that he saw only the Claudia, with its various branches, and not the Marcia at all.

¹ It is not far below the Anio Novus (i. 60) and was wrongly attributed to Aqua Marcia in *Builder*, 90 (col. 3, *ad fin.*).

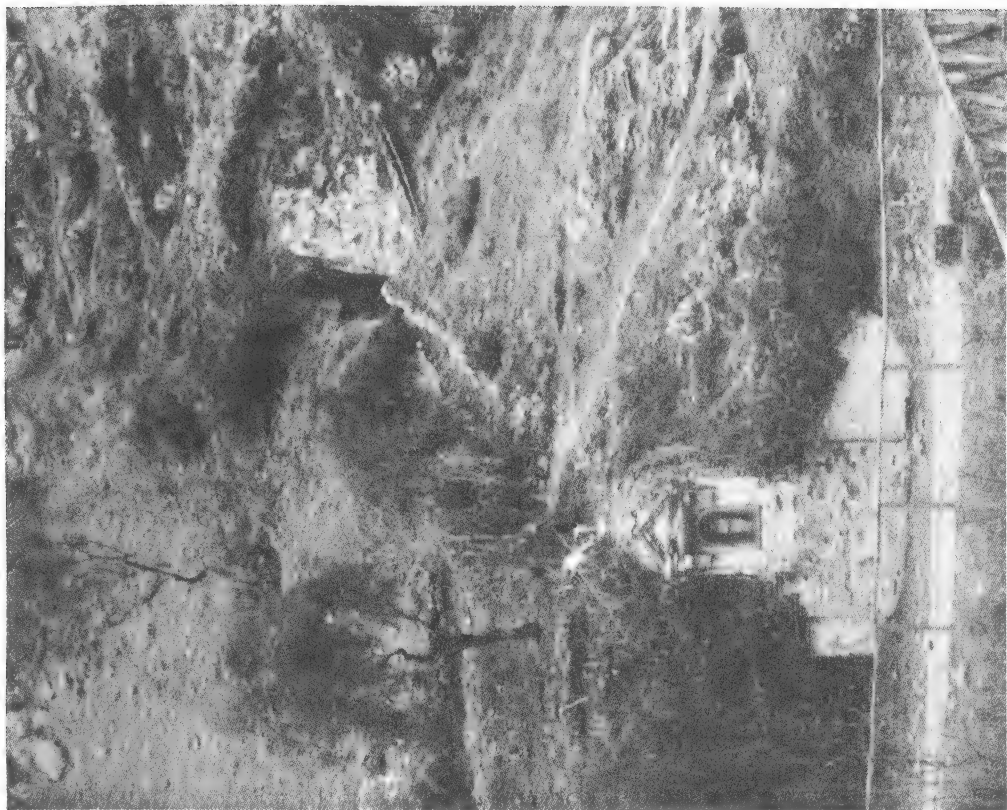
² See i. 59.

³ A wall in *opus reticulatum* at the lip of the cutting may have been a supporting wall, and was above the level of the impost. Some walls which are to be seen a little higher up on the ENE. bank of the stream belong to a villa with first-century black-and-white-chequered mosaic pavement, cut through and destroyed in making the conduit.

PLATE IX



a. AQUA CLAUDIA: ROCK-HEWN CHANNEL
AT S. COSIMATO



b. AQUA CLAUDIA: HADRIANIC LOOP AT VICOVARO

(c) *A possible branch-channel at Vicovaro.*

A second channel, divorced from the main aqueduct, appears at Vicovaro. Just below the church of S. Antonio, which is built on the massive ashlar substructure of Via Valeria, there are remains of walls of a *specus* 0.97 m. wide, built of limestone blocks, 0.60 m. high. The hard deposit at the bottom can also be seen for a stretch of some 16 m.: it was levelled at 274.07 (II. D, q). This level would give to the main channel an excessively rapid fall; and it is too low to correspond with the remains of that *specus* farther downstream (II. 34, &c.), which are mostly of original construction. Nor is it likely that there were two separate channels on the left bank until near II. 30. This channel might be either an overflow or the beginning of a branch on this bank of the river, of which other traces exist. But it may be wiser to exclude it from the Claudia altogether; its construction seems to point to an earlier period; and in the time of Statius¹ there was no aqueduct on the right bank available for the villas of Tibur.

Nibby² describes what was visible of this branch in his day, in the reverse order. The first traces he saw were just before reaching the chapel of S. Sepolcro, on the descent to the Fosso dei Ronci, but are no longer visible; nor are the next to be seen, which he describes as of a late period and made of irregular blocks of stone. But his third piece, a *specus* closely resembling that of the Anio Vetus, which he describes as 'close to the wall on the left, built of squared blocks of tufa, with a heavy calcareous deposit', can still be seen. It is 0.75 m. wide with a gabled roof formed by two blocks of tufa, each 0.60 m. long and 0.15 m. thick; it lies in the bank on the west of Via Valeria, south of the nameless stream south of Colle Ottati,³ and is pointing 30° S. of E., as if winding round the hill. Ingegnere Marella informed me that remains of a similar aqueduct had been found in the works for the

¹ Stat., *Silv.* i. 3, 66-7 explains that the villa of Vopiscus drew its supply in a lead pipe across the Anio.

² *Schede*, iv. 30. 'Poco dopo la iscrizione [of Maenius Bassus] trovasi rasente alla via un'acquedotto interrato a sinistra costruito di tufi quadrati e nel cui speco rimane un deposito calcareo considerabile: altri avanzi se ne veggono pochi passi più oltre: dopo una leggiera discesa si scavalca un dorso e si perviene ad un ponticello che è circa al 26 m.: dopo questo si sale di nuovo e trovansi i ruderi di un'altro acquedotto con molto deposito calcareo nello speco: i materiali onde è formato sono tagliati a parallelepipedi irregolari e lo fan credere opera dei bassi tempi . . . La strada dopo la Madonna di Vicovaro [also called S. Sepolcro, as on the map] comincia a salire e quindi traversa un acquedotto, del quale rimangono tracce a destra': cf. *Analisi*, iii. 482, 'anticamente sembra che fosse (il fosso) raccolto in un'acquedotto del quale rimangono ancora le vestigie'. Volpi (*Vetus Latium*, x. 448) may be referring to the same aqueduct, when he says that he saw traces of a subterranean channel on the right going towards Tivoli in the estate of Paolo Landi of that town. He attributed it to a branch of the Marcia for the supply of the villas.

³ The 40th kilometre stone of the modern road is just south of the bridge over this stream.

Acqua Marcia, in the approach road to the quarries (*Cave* on the map) between the Colle Ramanna and the Ruderì di S. Pietro, near the south-west mouth of the tunnel preceding Castelmadama station. It was also traced opposite the Villa Cucuzza (on the west edge of the Castelmadama map-sheet), where it was 0.80 m. wide, but is now concealed by a modern wall; and again to the south of Colle Vescovo.

Still farther west, along the road which follows the right bank of the Anio in the gorge just below the waterfalls at Tivoli, three aqueducts are traceable, as already recorded in the writer's description of the district.¹ Only one of these can be connected with the great aqueducts. This was discovered in 1906 at the junction of Via Valeria and the Strada di Quintiliolo. It was 0.85 m. in width, and preserved to a height of 0.95 m.: its sides and floor were of bad concrete, the sides 0.45 and 0.49 m. thick, the floor 0.30 m. The *specus* was full of dirt, and much deposit has been used in the concrete of the walls. It ran 20 degrees N. of E. Its date is quite uncertain. Other channels must be local, and Dessau² rightly comments on the care that Tibur took of its water-supply. He cites an elaborate inscription about the use of water for irrigation,³ and also notes the number of municipal officials⁴ who had charge of the supply, a *curator aquae Tiburtis*, a *tribunus aquarum* and a *praefectus rivi supernatis*, who was perhaps also *praefectus salientium*. Landowners of Tibur had, however, duties in regard to aqueducts for Rome flowing through their land. In A.D. 471 *Flavius Valila*,⁵ *qui et Theodovius*, gave estates to a church at Tibur on the condition *non solum [solum] solempnem modo agnoscat fiscalium functionem, verum etiam propagationi (pro purgatione) formarum peracti (perinde?) ab omnibus domini(s) huiusmodi prediorum dependi consuevit*.⁶ and it would appear that such estates were called *forme(n)sia* because the aqueducts ran through them.⁷

(d) *S. Cosimato to Tivoli. Maps 5, 6, 7.*

Returning now to the original channel on the north bank of the Anio, we find that, after branching at the gorge of S. Cosimato,

¹ PBSR. iii. 160, 161; cf. *Atti della Società di Tivoli*, iv. 14, n. 2 = *Via Tiburtina*, 81, n. 2.

³ Ibid. 3676; *Lanciani*, 113: 325; cf. *CIL*. vi. 1261.

² *CIL*. xiv, p. 267.

⁴ Ibid. x. 6274, 3674, 3682. The *circitores formae superscriptae* of the IVth or Vth century (*CIL*. x. 3649) are probably inspectors of one of the aqueducts which supplied the city of Rome, perhaps the Marcia; cf. Frontinus, 117. The *decani* mentioned are simply foremen, and the total was three *decani*, nineteen *circitores*, four growing boys, and two girls, besides other children. See Dessau, *Ann. Hist.*, 1882, 132; cf. *Bollettino di Tivoli*, i. 99.

⁵ For this noble Goth, who dedicated the Basilica of Junius Bassus as the church of S. Andrea cata Barbara Patricia in the time of Pope Simplicius (468-83) see *Lib. Pont.*, xlviii. 1. He is styled *V.C. et illustris et comes et magister utriusque militiae*; cf. *CIL*. vi. 32169.

⁶ Bruzza, *Regesto della chiesa di Tivoli*, no. 1.

⁷ Dessau, *CIL*. xiv, p. 367, n. 1.

it ran along the hill-side, and is seen running through the rock north-west by west, in the railway cutting, just at the west end of the tunnel under S. Cosimato; it passes under the north end of the bridge which carries the path from the gorge over the railway (II. D, m).

There were traces¹ of the *specus*, running west, a little above the railway west of *casello* 52.164. These have now disappeared, but important remains are visible well above the steeply graded line, on the slope some 150 m. NW. of the *casello*. The *specus* is 0.87 m. wide, with walls 0.80 m. thick, faced inside, at first with original *opus reticulatum* and then with rough tufa blocks of a late date. In the cutting east of the bridge² over a small stream descending south from the Casina Nuova, the bottom of the *specus* exists in rough concrete (II. D, n). It was also to be seen in the olive-yard on the east side of this stream (II. D, p):³ the rounded roof made a sudden drop of 1.10, but has now been obliterated or destroyed. Its height could not be determined; judging by the levels, it must have been over 3 m. A fifth portion of the *specus*, lined with rough concrete, was seen again in the bank above the next railway cutting, between *caposaldo* 232 bis and the railway bridge over the Anio. Here it was levelled at 288.08 m. (not in *Livellazione*).

At Vicovaro the Claudia crossed to the south bank of the Anio by a bridge, of which little remains, and so rejoins the later loop. There was probably no road bridge here in Roman times. At all events, the aqueduct, because of its orientation, claims the limestone ashlar⁴ of the first pier (Fig. 17), in alternate headers and stretchers, 0.58 m. high. The brickwork of the north abutment on each side of the entrance to the road bridge also belongs to it, and is good Hadrianic work. The west buttress of the north abutment projects 2.20 m. and the width over all, including both buttresses, is 9.50 m. The angle upstream is slightly rounded—a fine piece of construction. The bottom of this pier is defended from erosion by a lower brick wall running upstream for another 13 m. There is now no trace of the other pier which we must suppose to have existed in the stream (east elevation, Fig. 17), but on the left bank some masses of concrete still remain (A), while others (B) lie loose in the stream. Canina⁵ supposes that the bridge originally had

¹ Here it was built of small blocks of limestone with brickwork below: the level was identical with II. D, m.

² *Caposaldo* 232 bis is on this bridge.

³ This piece seems to be shown by Fabretti (65: 59, Diss. II, tab. i, No. 7).

⁴ Nibby notes this piece of aqueduct (*Analisi*, iii. 483; *Schede*, iv. 31-3). He describes remains in ashlar in the bridgehead and in the pier nearest to Vicovaro. He also notes four round horizontal holes on the left of the bridge which may have served for the drainage of the ancient town, which are now no longer visible.

⁵ vi. 141.

two stories, and measured no less than 105 m. long and 31 m. high: but these estimates are excessive.

In the little valley east of Vicovaro station, above the railway bridge (between I. 58 and II. 33), the writer saw the channel of an aqueduct 1.13 m. wide, with a concrete planked roof, and rounded top 0.55 m. thick. It has two or three turns, but the main direction is SSW. It was in 'cut-and-cover' work, faced internally with brick, perhaps of the Flavian period. It is now destroyed by the power conduit.

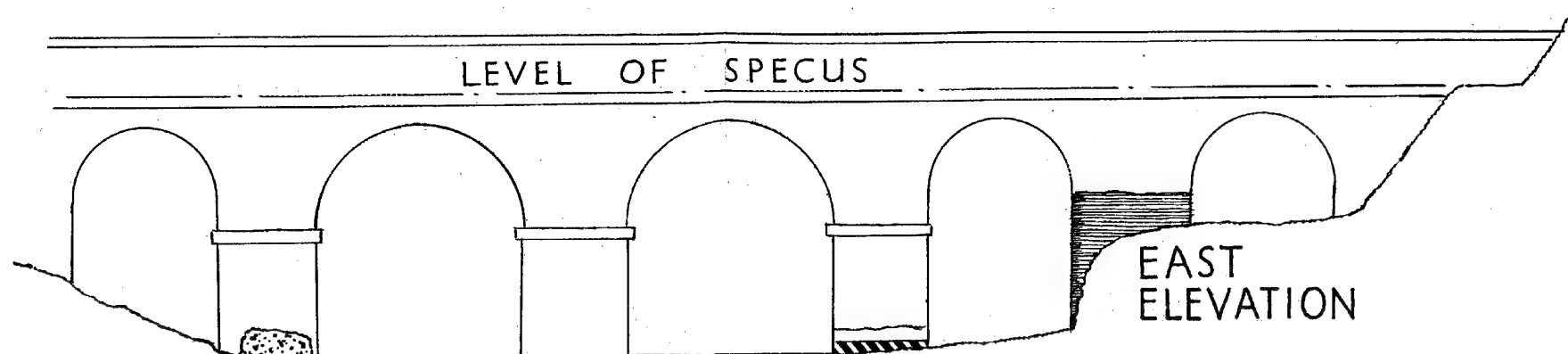
The lower of the two *specus* visible at the railway station must go to the Claudia. It is of bad late brickwork (II. 33), but can be traced for some distance. At the mouth of a small disused quarry opposite the south-west end of the station the *specus* appears again; it is 1.03 m. wide, with sides and rounded roof of unfaced original concrete, in rough grey mortar and large *caementa* of local tufa. It is half choked with foul, dirty deposit, discoloured by the dark local pozzolana used in the mortar—so foul that were it not for the existence of the other *specus*, one would feel inclined to attribute this one to the Anio Novus. Above it and 0.26 m. behind it is a retaining wall 0.89 m. thick, faced with bad brickwork (Severan or later), which probably served to protect it from falls of earth from above: and a little farther south-west the exterior is faced in *opus reticulatum*, with tufa quoins of coarse work, set in poor grey mortar, probably original. There is a buttress 1.57 m. wide. We then see it in the larger modern quarry in which the Anio Novus is exposed; while on the opposite bank of Fosso le Giunte we see more *opus reticulatum* with buttresses 1.77 m. wide, together with part of the *specus* itself.

Opposite *casello* 50.351, in the quarry, the bottom of the *specus* is visible (II. 32). In the path, a little to the south, the writer saw a circular inspection-shaft in *opus reticulatum*, belonging to this aqueduct (those of the Anio Novus are rectangular), 1.68 m. in internal diameter.¹ It is now almost filled up, and only a small hole is to be seen.

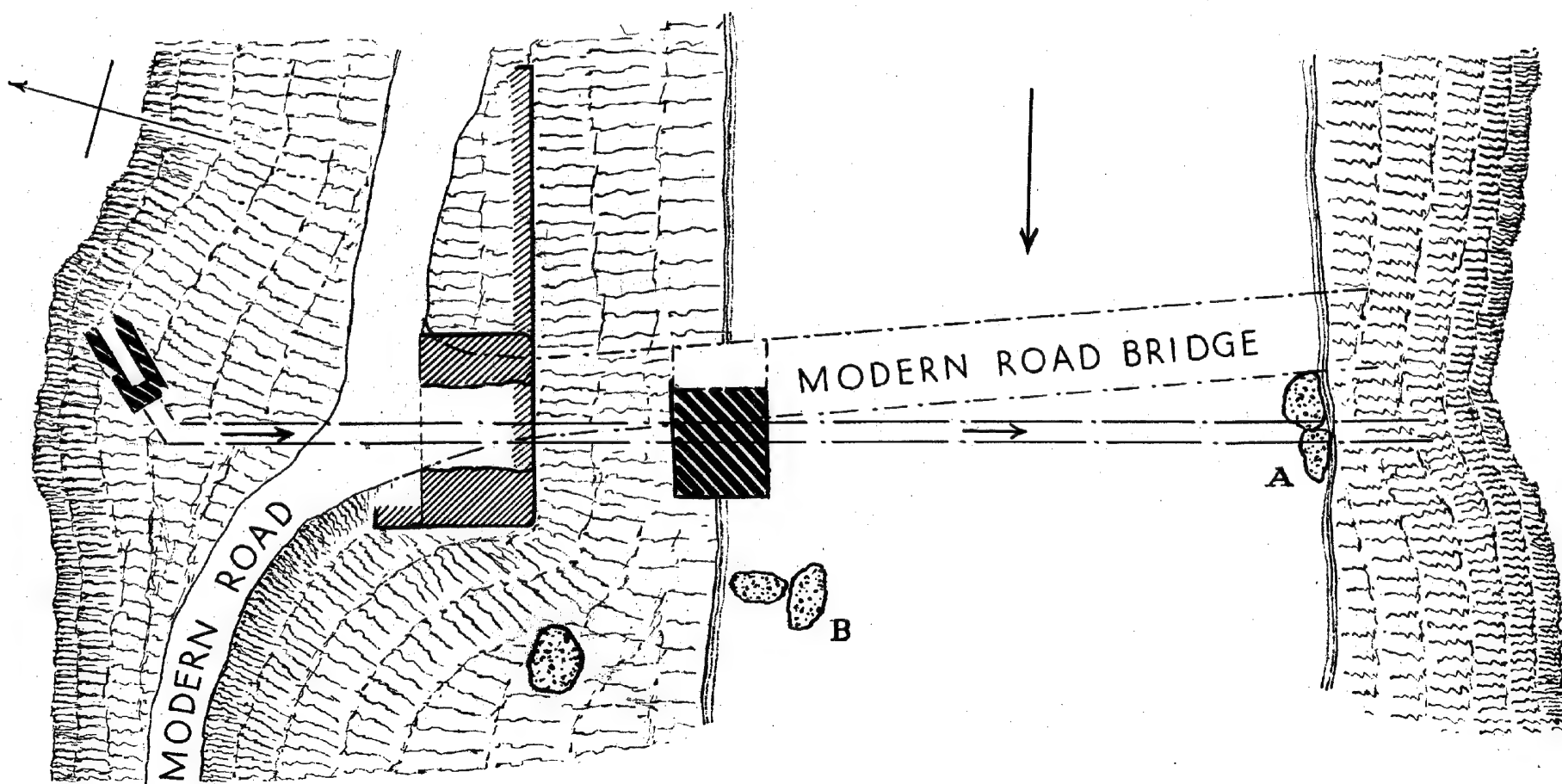
In the Fosso Salone, immediately below the concrete bridge of the modern power-conduit, are remains of the Aqua Claudia; part of the original *specus* is preserved, but most is a late restoration in *opus mixtum* with much deposit. The arch over the stream has gone. The *specus* was almost entirely filled with deposit, and on the east bank the concrete has been removed, though on the west it is preserved (II. 31). It is some 20 m. up-stream from the path: and the bottom of the *specus* is then seen on a level with the path, which rises and runs high over the hill.

To the south-west of the railway bridge over the Anio, about

¹ *Builder*, 91.



MAIN BRIDGE OF AQUA CLAUDIA AT VICOVARO

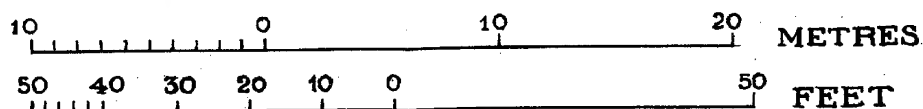


OPUS QUADRATUM

BRICKWORK

A. CONCRETE IN POSITION

B. DEBRIS



a kilometre below Vicovaro, just below the entrance of 'Prima Galleria Alli' in the power-conduit, there are massive remains of the Aqua Claudia, rightly identified by Lanciani,¹ who estimated their total length at about 60 m. The channel here runs along the hill-side, and is supported on the lower side, both north and south of a small stream,² by massive walls of concrete, with buttresses. These are overgrown on the north of the stream, but on the south there are plainly to be seen seven massive buttresses³ faced with reticulate work of tufa with stone quoins, of the period of Hadrian. Here a modern pink-washed house (the *casa colonica* of the *Livellazione*) is built upon the aqueduct, and immediately under it lies the original *specus*. It is 1.09 m. wide, exclusive of a cement lining 0.03 m. thick, with side-walls 1.48 m. thick, and a few metres to the north of the house it is 3.10 m. high,⁴ including the pointed roof (II. 30). Thirty metres farther south, near a small *capanna*, there is a stretch of some 15 m. of walling, belonging to a hill-side *specus* in concrete, with brick facing of the time of Hadrian: the *specus* itself is not visible.

Some 200 m. farther south, in the next lateral valley,⁵ there is a bridge of the Aqua Claudia, situated some 40 m. west (down-stream) of that of the Anio Novus (I. 54). It too had a single arch, originally of ashlar, flanked by concrete abutments faced with *opus reticulatum*: the abutment on the right bank was enclosed with concrete, faced with fine *opus reticulatum* of the Flavian⁶ period; the central arch was replaced in brick-faced concrete in Severan times; and after his day the right abutment was enclosed in brick-faced concrete (II. 29). The *specus* has recently been opened up at the north (upper) end of the bridge, and has a roughly rounded roof, 0.50 m. high, of the original period: its width is 1.01 m. from lining to lining.

Not more than 150 m. to the south again is a well-preserved portion of the *specus* of the Aqua Claudia, turning sharply, with a round shaft just before the turn. After the turn, on the lower side, it is supported by a late brick-faced substructure with five buttresses. The *specus* is at least 2.19 m. high to the gabled roof, which was in concrete set on planks, and gave a further

¹ Lanciani, 136 : 348. The writer (*Builder*, 91) wrongly attributed them to Anio Novus.

² It is on the southern edge of the Vicovaro map sheet.

³ Each of them is 2.07 m. thick: they project 2.39 m. and are from 2.65 to 2.75 m. apart.

⁴ The distance between this and the last point levelled is about 50 m.; and unless we wish to assume an extremely rapid fall (no less than 1.41 m. or 28.29/100) for which there is no apparent reason, we must assume the *specus* to have been even higher at the last point.

⁵ It is on the north edge of the Castelmadama map sheet, and opposite to the tomb of Maenius Bassus.

⁶ This account naturally supersedes my previous statement that it had 'had no less than three reinforcing walls in *opus reticulatum* successively applied to it', *Builder*, 91. The dating of these periods is due to Dr. Van Deman.

height of 0.51 m.: the deposit is 0.17 m. thick, and very hard. There is a circular shaft in the roof. The *specus* is seen again farther south, but then disappears for a while as the ground rises.

The extrados of the *specus* was seen to the south-west of *casello* 48.423 (II. 28);¹ but then it disappears again under the steep slopes of the Colle Stefano for almost a kilometre, until the Fosso della Vallana² is reached. Here the valley of this stream, and of another (nameless) one to the north of it, is crossed immediately above their confluence and some 650 m. above Aqua Marcia (III. 27) by a long bridge. The nameless stream passes under the Piano Maiuro, a name which has therefore been adopted for this bridge (II. 27). The bridge (Pl. X *a, b*) is nearly 200 m. long, and it is curious that it should have been thought necessary, when the Anio Novus avoided all bridging by crossing both valleys a little higher up (I. 53).

The central portion of the original bridge was built of ashlar resting on foundations of concrete, now exposed by the lowering of the ground-level;³ its upper works and abutments were of concrete faced with *opus reticulatum* with tufa quoins. Only a little of the ashlar is visible, comprising the arch over the north branch of the stream, and a little on each side of the south branch, on the north bank at C, on the south at section AA.⁴ It also appears at gg, between the fifth and sixth and seventh buttresses on the north side. Immediately under the *specus* there is a course of blocks projecting as an oversailing course on each side (see section AA). The aqueduct in its first form was thus about 3.10 m. in width over all, the *specus* being 1.00 m. wide and the side walls 1.05 m. thick,⁵ as seen at the north end. The height of the *specus* was fixed at 2.31 m. when the levelling was done.

Originally, the *specus* walls were not supported by buttresses. The first reinforcement, dating from the Flavian period,⁶ was a concrete wall 0.60 m. thick, faced with *opus reticulatum*, as visible at the north end, and strengthened by buttresses, 1.11 m. wide, projecting 1.77 m. At the south end *opus reticulatum* facing may be seen on the greater part of the east side, from the straight joint at *f* southward: on the west side there is a later reinforcement in concrete, faced with very fine brickwork of the Severan

¹ This *casello* lies at the north end of the last tunnel before the station of Castelmadama, where the railway crosses the high road on the level.

² This name occurs on the 1906 Castelmadama map sheet, applied to the south branch, in the earlier issue called Fosso Ariano (*sic*). The north branch which passes below the Colle Stefano and the Piano Maiura, is nameless: it is from the latter that the name Ponte Majuro (*Livellazione*, pp. 61-2) is taken.

³ See the elevation at BB.

⁴ In the interval there were probably three arches.

⁵ A footing 0.15 m. wide may be seen at *a*.

⁶ The dating is Dr. Van Deman's.

PLATE X



a. AQUA CLAUDIA: SEVERAN WORK, FOSSO DELLA VALLANA



b. AQUA CLAUDIA AT FOSSO MAIURO: S. PORTION, LOOKING WEST

period, supported by ten buttresses. Work like this is also visible on the east, going south of the southern stream up to point *f*; and a brick arch (*d*) 0.95 m. in span, now reinforced the original stone one. The *specus* (Pl. X *b*) is here at least 1.95 m. high, with the addition of a pointed roof, 0.88 m. high;¹ its width is 1.00 m., narrowed by deposit to 0.40 m. at the bottom. It is lined with Severan brickwork on the west, but on the east, at AA, the concrete is faced only by three courses of brickwork, immediately below the impost. There has been a later restoration of this side² and of the pointed roof. Farther south, at *e*, is a *puteus*, 1.10 m. wide, lined with brick, as is now the *specus* on both sides. There is no trace of earlier lining of the *specus* in the southern portion of the bridge. The point, however, where the Severan work can best be studied is between the two streams (Pl. X *a*, *b*; in the second of which the damage that is being caused by the roots of trees is worthy of note). Buttresses are added at regular intervals, with small arches, 1.00 m. high and 1.20 m. wide, between them, corresponding to the seven original stone arches. Above each arch comes a pilaster, breaking the space between the buttresses. These pilasters occur in other structures of the same period; they begin level with the bottom of the *specus*, where the buttresses end in steps (section BB). At the same period the north branch of the stream was confined in a concrete bed with brick walls.

Aqua Claudia does not reappear, as do the Marcia and Anio Novus, in the small intermediate valley, north of point 311, north-east of Costa di Colle Mare. It must continue to run underground towards the south-west, up to the wide deep Fosso della Noce, north of Castelmadama, where is a conspicuous bridge of the modern power-channel. A few yards downstream from this bridge, easily visible from Castelmadama railway station on the opposite bank of the Anio, there is a large and prominent bridge of the Aqua Claudia, with central portion collapsed. There are other structures in this valley belonging to the Anio Novus and to the Marcia, all of which may well be considered together (see Fig. 18).

The remains are not immediately intelligible, but seem to be explicable³ as follows. Firstly, there is a small mass of concrete, lying some 10 m. upstream from the bridge of Aqua Claudia on the right bank of the valley. This is probably the head of the later bridge of the Anio Novus (not in Fig. 18); while a small

¹ *Livellazione*, fig. 52.

² Two periods may be distinguished in the east wall here (see section AA). The north *specus* wall is 1.40 m. thick, the south one 0.88 m., giving a width of 3.28 m. over all.

³ As always, the dating of these constructions is owing to Dr. Van Deman's discussion on the spot with myself.

portion of *specus* at *a* seems to mark a downward channel from Anio Novus to Aqua Marcia.¹ The intrados of this *specus* was levelled at 273.94 m. (I. 52), and it is 1.20 m. wide with walls 0.85 m. thick, faced inside with brickwork and outside with *opus mixtum*. It probably belongs to the post-Severan age, representing all that is left of the later bridge of the Anio Novus.

Secondly, there exist a pier of unfaced concrete (*f*) on the right bank, on which the level 269.17 m. was taken (II"), a mass of rock (*g*) in the stream, and, on the left bank, an ashlar pier (*h*), reinforced in concrete faced with *opus reticulatum* and brick, where *caposaldo* 228, 268.88 m., was placed. These remains are too high for Aqua Marcia, and they do not, as the writer once believed, belong to an original bridge of Aqua Claudia. By exclusion, they seem to be the original bridge of the Anio Novus, which, in this case, would have passed below the Aqua Claudia, recrossing before the next valley in which they both appear (I. 46; II. 24).

Thirdly, a retaining wall faced with *opus reticulatum* with tufa quoins, at *k*, on the left bank, seems to fit the Aqua Marcia, since the level 259.85 m. (III. 26) was taken on a course of tufa blocks in it. With it may go the ashlar work at *j*, but the blocks *in situ* at *i* cannot be assigned with certainty.²

Fourthly, a concrete abutment on the right bank belongs to the original bridge of Aqua Claudia and is preserved for a length of about 11 m. as far as *b*. This was originally faced with brickwork. After its ruin an entirely new bridge,³ now the prominent feature (Pl. XI), was built under Severus. The intrados of the *specus* which ran over it was revealed by a hole in the path near *a*, where it seemed to be running 35° S. of W.; and shortly afterwards the bridge itself begins. Eleven arches are still preserved on the north-east bank, all in brick-faced concrete. The central portion has now entirely disappeared, except for debris in the stream;⁴ but it must have been in two tiers, with a total height of about 21 m. In the existing work some strengthening was done during the process of construction by filling in the panel between the second and third piers and adding a buttress which shares a string-mould with them, and by adding also a similar buttress (*c*) just before the lower tier of arches began, and bonding in its upper part (section AA).

The bottom of the *specus*, lined in cement 0.30–0.40 m. thick, is marked by a tile string-mould, on which a level (268.89 m.)

¹ At the time of our levelling operations we attributed it to the original bridge of the Anio Novus.

² Their heights are 0.60–0.67 m.

³ Sketched by Nibby, *Schede*, iv. 33. 33.

⁴ In this there are traces of very late restoration in which river pebbles have been used.

FIG. 18

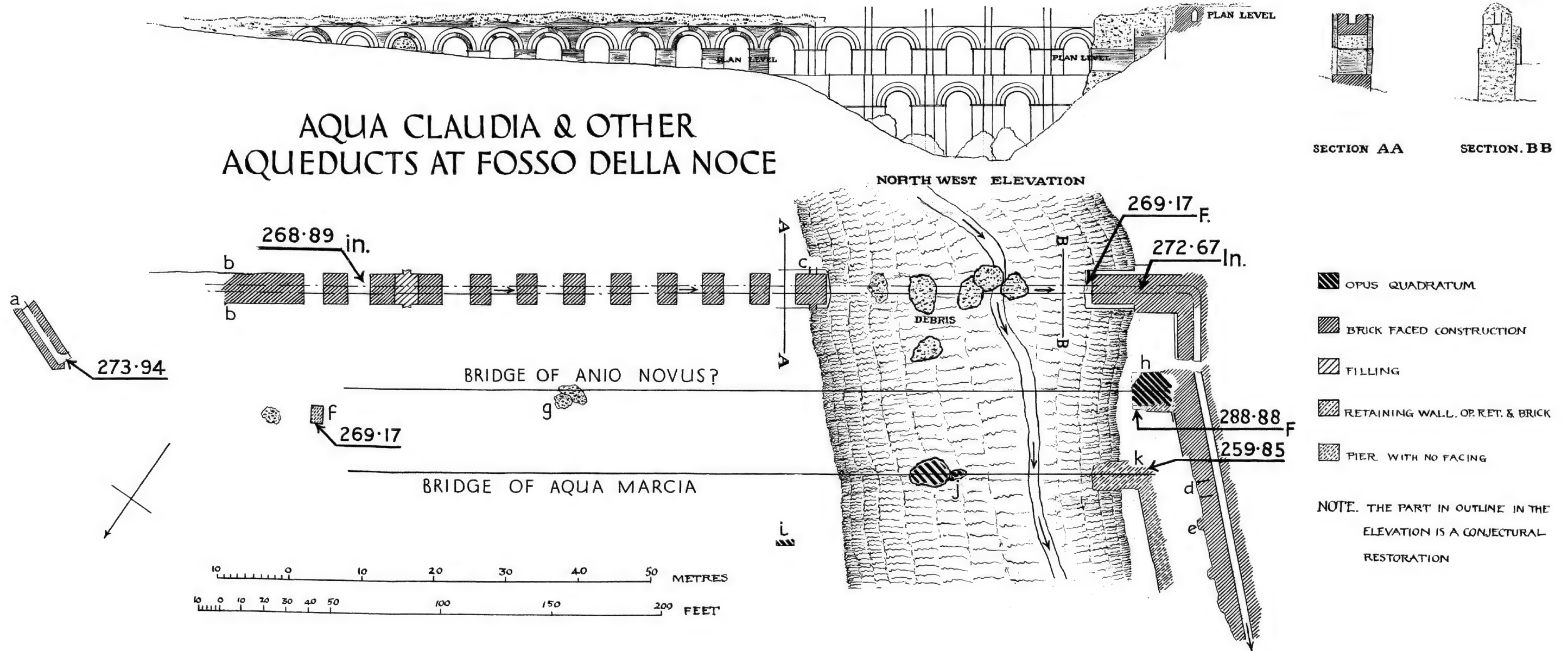
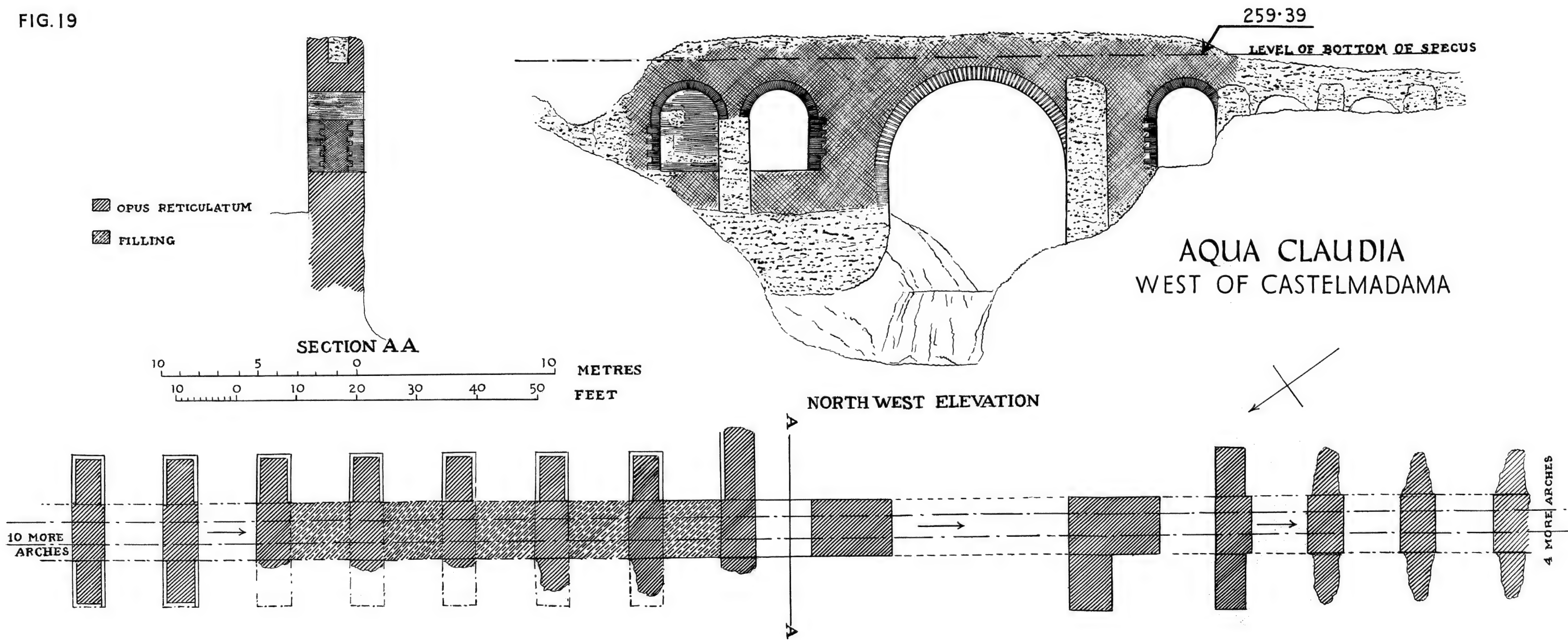


FIG. 19



was taken on the right bank; the offset below it 0.15 m. wide. On the left bank the solid concrete abutment is in great part preserved (section BB) and here the dimensions of the *specus* can be taken (II. 26).¹ It is at present entirely choked with foul deposit; and this suggests that it may once have carried the Anio Novus as well. But this was hardly the permanent arrangement, for even this very large *specus* would hardly have sufficed to carry both aqueducts. The later bridge of the Anio Novus has probably disappeared.

Immediately after leaving the abutment the aqueduct turns at right angles, and is supported by lofty concrete walls along the steep slope, faced with brickwork of the same period. At *d* is the face of a buttress in *opus reticulatum* belonging to an earlier wall farther in: the footing of this buttress, in limestone concrete, extends also under *e*, which is therefore later. The retaining wall of the Marcia lies still lower down the slope. The *specus* could then be traced at the ground level for some way, until buried under the embankment of the new power conduit; both the outer and inner walls were faced with original *opus reticulatum* and brick, retained below by a wall of the Severan period (II. 25).

Traces of Aqua Claudia were visible in the next gully, below the Anio Novus (I. 50), before the construction of the 'Alessandro Volta' power house; but nothing is now to be seen. We do not meet it again for about another kilometre, some 500 m. downstream of the modern bridge which carries the road from Castelmadama village over the Anio. Here, in the valley of a nameless stream, which passes west of the village and falls into the river near Fonte Luca, there is a piece of the *specus* in typical original construction, with three buttresses, running along the side of the hill. Then the stream is crossed, just below the junction of a small brook, by a long and well-preserved bridge of the Aqua Claudia, belonging in the main to the original period. It is in concrete faced with reticulate work, without traces of repairs or reconstructions, except for late filling of five arches on the north bank. The central arch over the stream has also been repaired in tufa voussoirs alternating with groups of three tiles, while the spandrels of the arch have also been refaced with Hadrianic brickwork. Only the central portion of the bridge is shown in Fig. 19; ten arches² are omitted at the north end and four at the south, the total number being 27. The arch over the stream has a span of 9 m., while the others are a good deal smaller: the buttresses.

¹ In *Livellazione* the fall from II. 27 is given as only 0.66‰, giving an absolute fall of 0.54: this is the result of taking the intrados, and not the bottom, as a basis of comparison.

² As well as the north abutment, a concrete wall supported by buttresses, near the end of which there is a half right-angled turn three buttresses before the bridge begins. There is a low abutment on the south also.

usually project as much as 2.50 m., and, though not bonded in, are of original construction. Over the first arch south of the stream the bottom of the *specus* was levelled at 259.39 m. (II. 24).

The *specus* is again seen in the small stream immediately westwards; but, unlike the Anio Novus and Aqua Marcia, it keeps underground all along the steep eastern slopes of Monte Papese, and does not emerge for over a kilometre, when both it and the river Anio have begun to run due west (II. 23). It is of coarse concrete, faced with original *opus reticulatum*. It soon turns with the river, to run southward, and near a *capanna*, about 75 m. farther on, it has recently been exposed by quarrying operations, which have cut through a part of the channel. It was here built of rough original concrete, unlined, with a rounded cement roof set on planks; and there is a square *puteus*, faced externally with *opus reticulatum*. Above the upper dam of the intake basin of the modern power channel, which runs to a new power station opposite caposaldo 210, a little way above Tivoli, and also in a stream-bed opposite the basin itself (II. 22), and almost due east of casello 44.836, the *specus* (II. 21) may be seen, and is similar to that described above. It also occurs in a small gulley about 500 m. from the dam, being original and 1.05 m. wide.

In the cultivated land, where a buttressed piece of the Marcia is seen, Aqua Claudia has been exposed. We saw the top of the *specus* and the intrados in October, 1926, just below the hedge dividing the fields from the steep pasture of Monte Papese. The path now runs above the hedge, but, immediately after the cultivation ceases, a branch of it descends to the Anio, and in this the bottom of the *specus* was levelled at 254.65 m. (II. 20). The *specus* is of late work, and the sides have collapsed. Again, it would seem not improbable that a *specus* found in making a fountain at caposaldo 221¹ (260.08 m.) about a kilometre farther on, was that of the Aqua Claudia; the writer saw it in 1911,² but it had disappeared in 1915, and could not be levelled. The bottom here would be at most at 253.50 m., and the top at about 256.50 m., if we allow the minimum fall of 1‰.

The Aqua Claudia then disappears until Via di Carciano, some 6 kilometres away, and more than a kilometre south of Tivoli, below Villa Braschi. In preparing the map it has been assumed that this aqueduct followed the Anio Vetus and Aqua Marcia; but no remains have anywhere been found, even at Ponte degli Arci, where they might certainly be expected, or at

¹ It is wrongly marked in the map too far to the east, whereas it is at the red circle a little to the east of the Casa Maria.

² Editor's note: it might equally well belong to the Marcia or Anio Vetus, as Dr. Ashby confesses on p. 108, where further details appear.

PLATE XI



AQUA CLAUDIA : SEVERAN BRIDGE AT FOSSO DELLA NOCE

Fosso Arcese. On the other hand, the presence of several portions of *specus*, some undoubtedly original, to the south of Tivoli, is reasonable ground for the belief that the channel passing along the slopes of Carciano is the original one. What Paquedius Festus did below Monte Affiano, and where the remains of his Domitianic *rivus aquae Claudiae* are to be sought, is a mystery.¹ Even if work of Domitian could be found in the arches crossing Valle d'Empiglione, that would not solve the question; for the original structure there dates from the time of Claudius and is shown by its levels and deposit to belong to Anio Novus. The entire lack of remains of Aqua Claudia between Monte Papeze (or, at furthest, Casa Maria) and Tivoli is a difficulty which seems to the writer insoluble.

(e) *Tivoli to Ponte Diruto. Maps 4, 5.*

After Tivoli the first remains possibly attributable to Aqua Claudia are of concrete visible at the top of the quarry, in which level IV. 10 was taken, some 3 m. below the Carciano road under the garden of Villa Braschi, between the middle entrance to it (by an arched footway) and the Villa itself, and to the north of the chapel of S. Maria di Carciano (il Romitello).² Since the ground-level of the Casino at Villa Braschi is 237 m. above the sea, this concrete cannot be higher than 230 m.; if it is lower it must belong to the base of the hill-side *specus*, or to a supporting wall of it. Above the same quarry there are also remains of a sloping concrete channel from the Claudia to the Marcia, perhaps of the period of Hadrian. The original *specus* has also been recently found a little south of III. 15, in building Villino Fattori, where a small stretch of it, 0.95 m. wide, is used as a chicken-house: the level of the bottom was, we were told, from 1.50 to 2 m. above the top of Aqua Marcia, that is, roughly $233.54 + 1.60 + 1.76$, or 236.90, above sea-level, supposing the bottom of III. 15 to have been correctly determined. The original channel can again be seen at the head of the small valley above the ruined chapel of Madonna del Padre Michele³ in two places, the second being in front of a retaining wall faced with *opus reticulatum*, below I. 31. In the quarry where point III. 14 is, the intrados was levelled in 1915; but nothing is now visible except some concrete and the cutting made in the rock for the *specus*.

The Claudia then appears below the *castellum* of the Anio Novus which is known as the Grotte Sconce (fig. 31). Here it is lined with irregular *opus reticulatum*, and is 1.10 m. in width, with a pointed roof: a circular *puteus* may be noticed. It is then

¹ See p. 268.

² Crocchiante, *Chiese di Tivoli*, 234.

³ *Supra*, p. 114.

seen on each side of the 'cataratta' or vertical shaft¹ (II. 19). Other traces, including a circular *puteus*, can be seen above the Marcia, going round the slope to the Voltata delle Carrozze.

Just south of this point a branch descended to the Anio Vetus. At the top the intrados was levelled at 233.34 m. (II. 18); at *a*,² 21.30 m. farther on, the bottom was levelled at 225.24, giving a fall of 8.10 m., less the height of the *specus*; 40 m. farther still, at *b*, the level of the bottom is 211.22 m., giving a fall of 14.02 m., or 35.05%; then, in another 2.50 m., comes the *specus* of Anio Vetus, whose intrados is at 213.33 m. This gives a total fall of 20.01 m. in 63.80 m. or 31.37%. The branch was 0.75 m. wide at first, and ran north-west, widening at *a* to about 1 m. and turning west; its sides were of rough stone, but in most places the deposit alone was preserved, and no trace now remains.

The sector of main channel which now follows shows slight variations in the height of the roof; the bottom level is never reached, but the fall appears to be almost negligible. The remains are mostly original,³ in rough concrete following the hill-side. They are scanty just below and after Ponte Arcinelli. Above *caposaldo* 196, the *specus* of a later period may be seen, 0.90 m. wide, with extrados 0.50 m. thick. North of the Franz Stone (*caposaldo* 195) the *specus* (II. 17), with a rounded roof set on planks, is original, but refaced with bad brickwork: here is a *puteus* 1.15 m. square. South of the Stone is a curved piece of the aqueduct, built in Hadrianic brick-faced concrete, with six external buttresses; the *specus* has a pointed roof of planks set vertically, 1.05 m. high, so that the intrados was levelled at 233.14 m. (which is actually higher than at II. 17), while the impost was at 232.09 m.⁴ A little way after this, below the so-called Galleria Egidio,⁵ the original *specus* is again visible for a length of some 100 m. On the north side of the second valley from Tivoli, north of *caposaldo* 194, are two late pieces of hill-side *specus* with external buttresses; the first has eleven buttresses, each 1.20 m. wide, with a projection of 1.50 m.; the second contains an almost square *puteus*,⁶ where the *specus* has a pointed roof 0.95 m. high.

The *specus* is now running very close to Strada di Carciano, and the next piece is seen under the road. The whole of the earlier channel appears to have been demolished, except for a rectangular *puteus* faced with *opus reticulatum*, refaced outside with post-Severan brickwork; the roof is pointed, 0.97 m. high (II. 161). Still farther on, below the road, north of *caposaldo* 193, there is

¹ *Infra*, p. 278.

² *Livellazione*, fig. 36.

³ Dr. Van Deman (and for what follows).

⁴ Canina, vi. 145; *Lanciani*, 47: 259 and pl. I. 5 (who attributes it to the Anio Vetus).

⁵ *Infra*, p. 279.

⁶ It measures 1.07 by 1.15 m.; the footholes measure 0.17 m. high and 0.15 m. wide.

more of the same kind of *specus*, faced with good Hadrianic brickwork. Then it rises above the road, and, below I. 27, there occurs a rectangular *puteus* faced with *opus reticulatum*.

At Fosso di Ponte Terra, some 100 m. downstream from the cistern of Anio Novus (I. 26) and 200 m. upstream from Ponte Pussiana, by which the Strada di Carciano crosses on its way to Gericomio, two separate channels cross the stream, some 15 m. apart. On the north bank the upper one is of concrete faced with late brickwork within and without, and the *specus*, about 1.20 m. wide, collapsed. It turns through a right angle from east to south immediately before crossing the valley: its foundations are not deep, and it has left no fallen concrete in the stream, though the abutment on the south bank is preserved. It is therefore doubtful whether there was an arch or not. The lower channel on the north bank has a *specus* 1.17 m. wide, with walls 0.90 m. thick, faced on the exterior with good *opus reticulatum* with tufa quoins and without restoration of any kind. On the south bank are foundations only, rendering it again questionable whether there was a bridge.

Both channels were seen by Silvestro Petroncelli, of S. Gregorio, who described¹ them for Revillas, noting that the arches had collapsed. He rightly attributes the upper channel to the Claudia; and gives the lower *specus* as 4 palms (0.88 m.) wide (too little), about 36 palms (8 m.) downstream, but about 6 palms (1.30 m.) higher in level. Even if his estimated levels are correct, though the difference seems less, the level (II. 16) of the intrados of the Claudia, obtained by us in 1915 on the north bank, just before these remains are reached, forbids the attribution of either channel to any other aqueduct. It was 229.08: and the Anio Novus is higher (239.12 m. at the intrados) than either channel some way farther on (see I. 25); while the Marcia, at III. 13, is already some metres too low (225.75 at the intrados). Thus, both channels must go to the Claudia, forming an exceptional case, where the channel was disused and replaced by another constructed alongside of it. There are no further traces of the Aqua Claudia in the neighbourhood of Gericomio.

The aqueduct next crosses the Fosso dell'Acqua Raminga,² up-stream of Ponte S. Antonio, by a bridge of much smaller size, and at a level some 14 m. lower. It was originally a single-arched

¹ PBSR. iii. 132 m.; the letter is dated 7 September 1739.

² Petroncelli (letters of 7 and 13 September 1739) notes a *puteus* belonging to it on the hill to the north, in the vineyard of Domenico Giorgini: it was rectangular (about 0.96 by 1.20 m.) and 64 palms (14 m.) deep. Revillas (*Vat. Lat.* 9024, f. 93 v.) had measured it also; while Cassio (i. 155) gives the depth as 70 palms, attributes it to the Marcia, but puts it at the foot of Colle Faustiniano, i.e. on the south of the valley. It was also seen by Nibby (*Analisi*, i. 33).

bridge, about 2 m. wide, built in ashlar of reddish-brown tufa; and the whole structure was enclosed by Hadrian in reinforcing walls of concrete faced with brick, while the *specus* was also restored. Both the stone arch and the later concrete one have fallen. The restored *specus* is 1.30 m. wide, but its top is ruined: the side walls are 0.90 m. thick, strengthened by buttresses, 1.18 m. wide, projecting 1.45 m. A level, taken on the bottom of the layer of cement at the bottom of the *specus*, read 219.40 m. (II. 15); below this is a tile course on top of the ashlar. The aqueduct turned sharply on each side of the bridge: on the north, before reaching it, it is running south-east by south, inasmuch as it had to pass behind the Ponte S. Antonio; whereas on the bridge it runs ESE. and afterwards it turns almost SSW. along the steep bank of the ravine. Petroncelli had already correctly assigned this bridge to the Claudia, while Cassio and Nibby wrongly attribute it to the Marcia, as the writer once did.¹ It is not noted by Canina or Lanciani.

The Aqua Claudia appears again at the southern extremity of Colle Faustini, running on a terrace which lies below the highest part of the hill yet well above the deep gorge of Mola di S. Gregorio. The channel goes parallel to the stream, in a south-easterly direction, at a considerable depth, as is shown in the section (Fig. 20). Before reaching the three round *putei*² there are great lumps of deposit, as if the *specus* of the Anio Novus had been destroyed in cultivation. The first *puteus* is 2.10 m. in over-all diameter, faced with *opus reticulatum*, and 1 metre across inside, with outer walls 0.47 m. thick and a square base of brickwork; the second and third are to be seen at intervals of 36.60 m. from centre to centre, or 35.60 (120 Roman ft.) from outside to outside. The next three are placed conjecturally. The channel then turned almost at right angles to cross the ravine, which lay 26 m. below it.

The immense bridge³ has fallen (Fig. 20), giving the spot the name *Forme Rotte* (broken channels). On the north-east bank only a little concrete is now preserved after a fall of the cliff which carried away some ashlar visible in 1899. In the stream and on the south-west bank are massive remains in tufa ashlar, drawn from quarries just above the south end of the bridge. Stonework seems to have been used only at the bottom of the bridge, brick-faced concrete being used above. The present structure presents no trace of restoration, and its brickwork is attributable to Antoninus

¹ *Builder*, 112.

² Wrongly attributed to the Anio Novus in *Builder*, 142. They are not later than the Flavian period, according to Dr. Van Deman.

³ Canina (vi. 146) gives a view, and a quite worthless reconstruction of the centre arch of each aqueduct: he fails to recognize that the usual order is here inverted, attributing, therefore, this bridge to the Anio Novus.

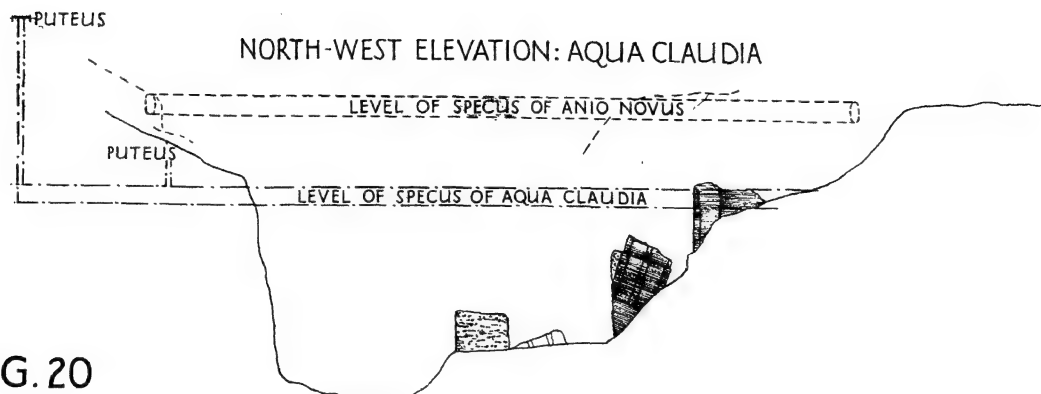
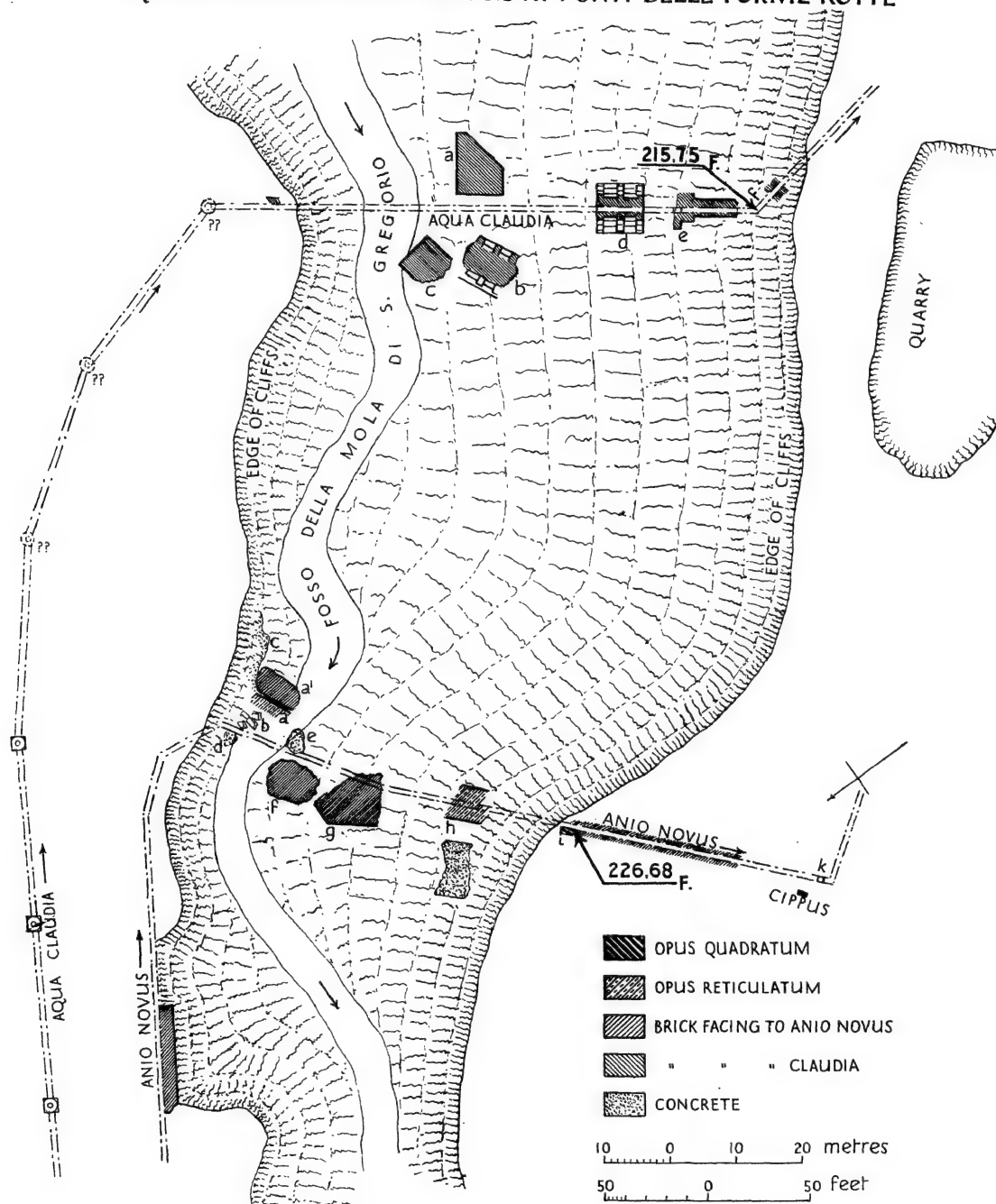


FIG. 20

AQUAE CLAUDIA & ANIO NOVUS AT PONTI DELLE FORME ROTTE



Pius,¹ a period not represented elsewhere in the aqueducts. If there was an original bridge entirely built in stone, no evidence for its existence appears.

The great buttress *a* is probably *in situ*, though considerably off the line of the channel, implying a width at this point of 23 or 24 m. for the base of the piers of this bridge: the buttress itself is 10–12 m. wide, 7 m. long, and 6 m. high. It is built in ashlar and brick-faced concrete, the former used exclusively in the lower part. To the other side of the line of the channel lie two huge fallen masses, *b*, broken by pilasters in the upper part, and *c*, probably part of the buttress corresponding to *a*. A fourth mass, *d*, has only slipped off its base, and is therefore almost *in situ*. From the bottom of the *specus* to the ground it is 9.30 m. in this fragment, and the *specus* is here 1.23 m. wide, with walls 0.60–0.65 m. thick. Finally, *e* is still in position, and has an ashlar base under the concrete. Directly under the *specus* there is a vertical strip of rubble, not more than 1 m. wide and at least 6 m. deep, enclosed between the ashlar, a curious economy of material in the centre of the core, which must belong to the original structure and may have been dishonestly substituted for stone by the builders. There is a *puteus*² at the south-west end leading in from the top, with footholes on the north-west; and, immediately after it, the *specus* wall on the north-west runs diagonally for 0.75 m., so that it becomes 0.30 m. narrower. The brick facing of the last part of this wall in *e*, from the buttresses onwards, is much later than that of the rest, and probably belongs to the fourth century: on the south-east side of *e* hydraulic cement 0.045 m. thick is plastered on the exterior, probably to prevent leakage. The bridge actually ended at *f* (II. 14), where the *specus*, here 0.85 m. wide, enters a tunnel in the rock, the roof being lined with concrete, and turns sharply SSE. It soon turns SSW. again (there are traces of a shaft belonging to it to the south-east of the channel of the Anio Novus) and passes under the *specus* of the Anio Novus.

The *specus* of Aqua Claudia may be seen again running SSW. in the Fosso dell'Inferno, which it crosses just below the junction

¹ On a *tegula bipedalis* in a bonding-course of *b*, I read the stamp *CIL. xv. 1065* (A.D. 142) and, on another that of *ibid. 2309* (which resembled a second-century stamp, in which case *ibid. 2310* is either second century also, or else belongs to a different person); and on three mortar courses I saw the imprints of two-line stamps similar to the last, which I was unable to decipher. I noted the imprint of *ibid. 223 a* (c. A.D. 140) on another *bipedalis* at the south-west end. Petroncelli, in his letter of 5 April 1740, gives a copy of the brick-stamp *CIL. xv. 1019. 7.* (c. A.D. 120) as having been found here. From an anonymous note among Fea's papers cited in *CIL. cit.*, it appears that three copies of this stamp were found, all on *bipedales*.

² It resembles the *puteus* in the bridge of the Aqua Marcia over the Fosso Maiuro (III. 27) which belongs to the time of Hadrian.

of the two branches. The pointed *specus* is 0.84 m. wide, with sides of small blocks of limestone 0.40 m. thick, and 0.30 to 0.38 m. high: while the roof is formed by two inclined slabs, each 0.68 m. high and 0.27 m. thick (II. 13). No concrete is seen in the construction, though there is some outside, perhaps belonging to a sluice of later period. The form of the *specus* is very strange for the Aqua Claudia; but the levels entirely prevent its attribution to any other aqueduct. Unless the level of the stream has changed, there must have been a tiny bridge over it, to which some loose blocks in the stream belong; but it would seem far more likely that this was an under-passage, exposed by erosion since Roman days.

That the Aqua Claudia tunnels under Acqua Rossa, and does not, as previously believed, cross the Ponte Lupo, is now quite clear. A *puteus* belonging to it is to be found in the Tenuta di S. Giovanni, on the hill south-west of this great ravine, about a kilometre north-west of the course of the Anio Novus. The name of the hill was given to the writer locally as Colle del Traione.

The *puteus* is 0.90 m. square, faced with *opus reticulatum*, and is open for a depth of 6.50 m.: and the direction of its sides makes the aqueduct run south-west by south. The writer was also told that other shafts had been found both to the north-east, where there is in fact much deposit, and to the south, in the vineyards towards the cemetery of Gallicano, where also, he was told, much deposit had been found. It is difficult to explain why the Aqua Claudia should have taken such a devious course as that indicated in the map, while the Anio Novus runs perfectly straight. But this shaft will not suit either the Anio Novus or the Marcia, while the presence of deposit excludes both a branch, or any local construction, such as a drain.

The Aqua Claudia, like the Anio Novus, must have passed under the small valley to the north of Gallicano. On the south of that village an aqueduct-bridge is indicated by Fabretti and Cingolani in their maps,¹ and attributed to Aqua Claudia. It is now² incorporated in the modern road-bridge called Ponte Scalino, and probably carried both Aquae Claudia and Anio Novus, if only because *putei* of both these aqueducts exist in the cutting of Cavamonte. On the east side, at the north end, three fine arches of tufa ashlar are visible: the stream-arch, if it still exists, is entirely encased in modern work, but there is another arch at the south end. On the west side only the late brick-faced concrete reinforcement is seen. The bridge is now 3.70 m. wide over all; on the west side are buttresses faced with aqueduct deposit, but the ashlar is visible, as the concrete is only underpinning the

¹ Cf. Nibby, *Analisi*, i. 473. It is not mentioned by Lanciani.

² *Builder*, 143.

arches and covering one opening at the north. A level, taken on the highest point of the tufa construction, read 199.86 m. (I. 20; II. 12), at about 1 m. below the level of the bottom of the *specus*.

Just after the divergence of the road to Palestrina¹ there is a shaft belonging to the Aqua Claudia (Map 4): it has been restored at a late period, being lined with aqueduct deposit, and is 1.55 m. in diameter. After this shaft Fosso Collafri is crossed by the modern road, a little north-west of Ponte Amato on Via Praenestina,² on a bridge which is also built upon an ancient one belonging to the same two aqueducts. This was originally of ashlar, of which nothing is to be seen but three buttresses on the north-east bank of the stream, two on the south-east, and one on the north-west side, while a few loose blocks lie in the stream. The rest is hidden by a reinforcement of concrete faced with bad, late brickwork, and some *opus mixtum* (on the south-east side). There are five arches at irregular intervals on the north-east bank, followed by a large piece of modern facing and a modern stream arch; then comes a single concrete arch, faced with late brickwork, on the south-west bank. The present width of the bridge is 4.70 m., or 5.60 m. from buttress to buttress, its total length 68.50 m., and it is 8.50 m. high at the stream to the top of the string-course of the ashlar buttress, 0.40 m. below the roadway. This string probably marks the bottom of one of the two *specus*, and a level of 188.81 was taken on the upstream side (I. 19; II. 11).

That this bridge and Ponte Scalino carried both the Claudia and Anio Novus is certain, from the existence, in the cutting of Cavamonte, immediately to the south-west, of three *putei*. Two of them, on the south-east side of it, belong to the Anio Novus. The third, on the north-west side of the road, belongs to the Aqua Claudia,³ and is cut in rock, with footholes at intervals of 0.50 to 0.60 m.; the one side entirely preserved is 1.46 m. long. The other three have been destroyed by widening the road in post-Roman times. There is no certain trace of Aqua Claudia beyond Cavamonte, though a curving wall of *opus reticulatum*, at the west end of the fountain by Casale del Fienile, may belong to it.⁴ It runs 10° S. of W. and is 0.60 m. thick. The *opus reticulatum*, which is partly made of aqueduct deposit, is irregular. There may be the curve of the *specus* at the west end of the fountain, though this is quite uncertain. Loose pieces of deposit, on the line towards

¹ There was probably an ancient road from Gallicano to the Via Praenestina following the line of the modern one, but where it crosses the valley is uncertain, for there is no trace of any other bridge. The zigzag by which the modern road ascends has been substituted for the steep rise which the path still follows; but the next hill, the Colle Collafri, is traversed by a deep cutting, which, though widened in modern times to 5.30 m., is probably of ancient origin.

² *PBSR.* i. 208.

³ Cf. *PBSR.* i. 207, 208.

⁴ *PBSR.* i. 205; *Builder*, 143.

the Ponte Diruto, seem to indicate a *puteus*, marked on the map.

The so-called Ponte Diruto, or Ponte Barucelli, consists of two bridges close together, the upper belonging to the Anio Novus, the lower to Aqua Claudia (Fig. 21). The aqueduct, which just before the bridge has been running due west, turns to 30° S. of W. on the bridge itself. The lower bridge is separated from the upper by only a very small interval; indeed, the two were connected by arches, 6.24 m. in span, running from the buttresses of the upper bridge to the exterior of the *specus* of the lower (*d, d, d*, Fig. 21, AA). The Claudia's bridge, downstream, was constructed of late brick-faced concrete, with wide arches very close together, turned in a double ring of tiles. In one of the arches (the first completely open are on the west bank) the tiles have been removed, and the cement lining of the *specus* is visible above it. The bridge was originally 3.50 m. wide, but the arches were subsequently filled, and, not very much later, brick buttresses were added. The two pairs of buttresses on the west bank were pierced by small arched openings, which break through the filling of the original arches. They project 3 m. and are 3.60 m. wide.

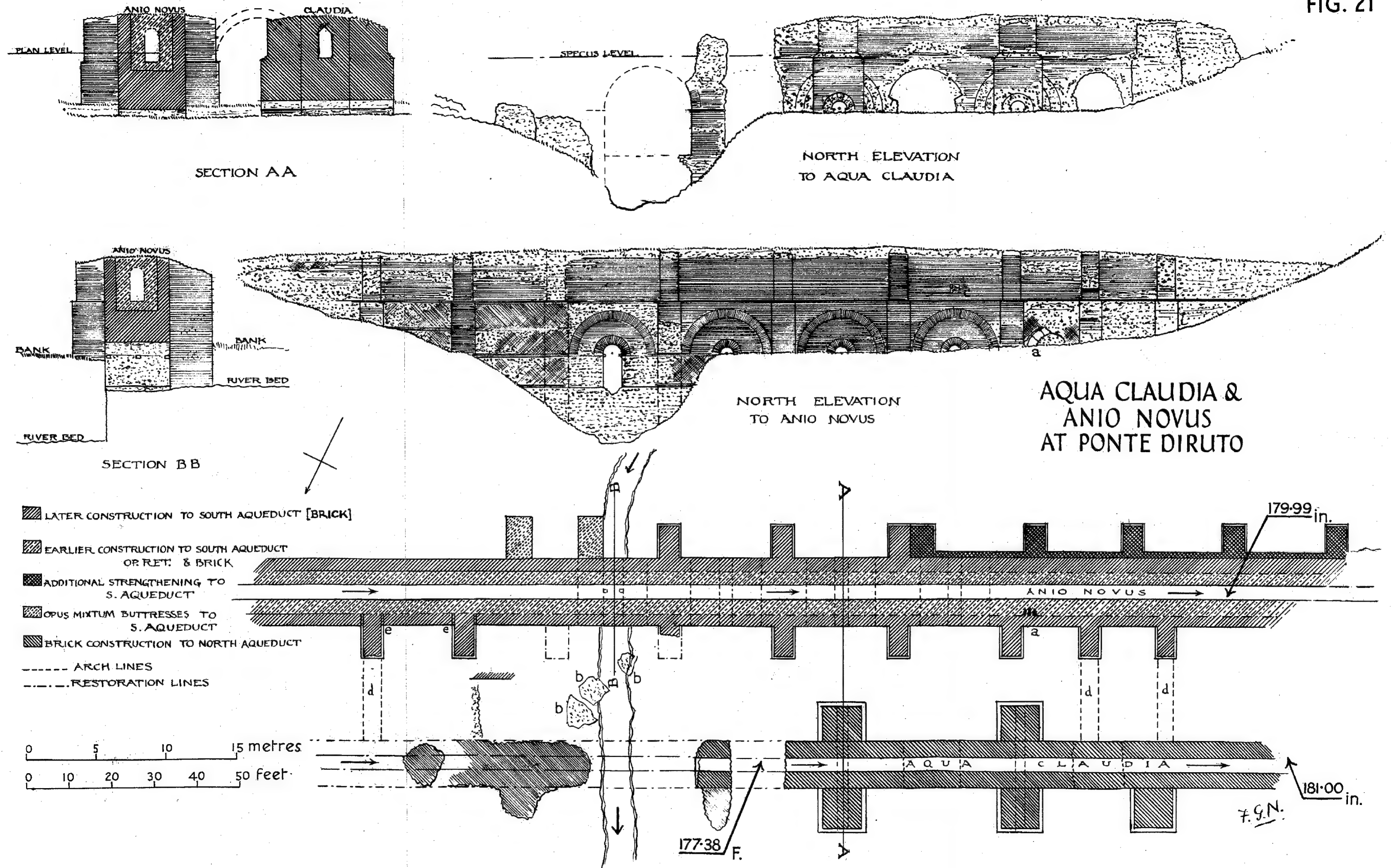
An increase in the thickness of the buttresses corresponds with the level of the bottom of the *specus*, as in the upper bridge. The portion at the stream has collapsed, leaving debris (B) about. The *specus* is exceptionally high (II. 10) and has a gable roof. The deposit, which is found right up to the roof, is very crumbly and foul, not at all characteristic of Aqua Claudia.

(f) *Ponte Diruto to Capannelle. Maps 2, 3, 4.*

After Ponte Diruto, the Aqua Claudia, like the Anio Novus, keeps underground until the Fosso Scuro or Fosso di Biserano is reached. Thus, above a sharp fall in the west branch of the narrow and deep Fosso dell'Acqua Nera, the aqueduct tunnels below the stream, thus saving the need of a bridge.¹ The stream-bed is only 5 m. deep, while there is an original shaft 10.50 m. deep on the east bank. Some of the concrete walling of this shaft is seen in the bank of the stream, and a tree grows right over it. The shaft is square and lined with *opus reticulatum* quoined in tufa. With the aid of several companions and a climber's rope, the writer descended the shaft, finding the *specus* to be round-headed and apparently unlined, with a little deposit at the bottom certainly characteristic of Aqua Claudia. The *specus* is cut in soft dark tufa, the intrados corresponding in level with the top of the heap of fallen earth at the bottom of the shaft. Wading along the

¹ It must be some 200 m. down-stream of the new field-wall marking the boundary between Gallicano and Colonna, and 130 m. from the old field-wall.

FIG. 21



line of the aqueduct from farther up, where it is blocked by earth, probably fallen from another shaft, we found it running first 13° W. of N.: at about 30 m. from the shaft it turns 33° W. of N., and runs in this direction through the shaft and under the stream. We waded also in this direction for 15 or 20 paces, but the water grew so cold that we went no farther. It must soon turn again sharply.

The hill west of this stream is called Colle del Persico, and on its west slope, above the next stream,¹ which descends NNW. past Fontanili di S. Isidoro and del Linaro, there are two *putei*, about 10 m. north-west of the communal boundary between Zagarolo and Galliciano. The nearest to the boundary is circular and about 2 m. from it; and only 5 m. farther south-west is another square one. Both are cut in the rock and show no traces of lining. There is little doubt that one belongs to the Anio Novus and the other to Aqua Claudia. Both are accessible from below, as there has been quarrying from the bank of the stream into a bed of *selce* overlying a much softer stratum. But there is no doubt that their present depth, some 15 m., has been very considerably reduced, and that the aqueducts run at a much greater depth. The discovery of these shafts, in 1927, made it certain that the *cippus* marked in the map a good deal farther down the slope of the hill, and attributed to Aqua Claudia, must really belong to the Marcia, running quite close to the Anio Novus. After passing under the small stream, the Aqua Claudia must have run due west, crossing the channel of the Marcia in its subterranean course.

The Aqua Claudia reappears in the deep eastern branch of Fosso di Biserano, crossing by the lower of the small stone bridges. That of Aqua Marcia, at 6 m. upstream, has already been described,² while the Anio Novus crosses about 150 m. farther upstream. The bridge (Pl. XII *a*) of Aqua Claudia³ is a single arch of concrete faced with ashlar⁴ below and *opus reticulatum* quoined in tufa above. A buttress still faced with small square blocks of tufa has been applied to the ashlar on the right bank, on the upper side of the aqueduct, probably at a late date. The bridge is 4.40 m. wide; the arch has a span of 2.90 m. and a height of 2 m. from crown to spring, so that it conforms more to the normal type than the arch of the Marcia. The blocks are not rusticated, and the construction is assigned by Dr. Van Deman to the original

¹ To the north-east of point 220, between the R. Cancellata di Mezzo and the R. Cancellata Grande, the stream passes under a natural bridge called the Ponte Piano (shown clearly enough in the later editions of the map) which is used by a modern path.

² See p. 124.

³ *Builder*, fig. 21 and p. 174.

⁴ The voussoirs are 0.70 m. in height; the blocks on the east side on each side of the arch vary from 0.72 to 0.74 m. in height, and 1.42 to 2.10 m. in length.

period. The *specus* cannot be seen; but the level, taken on the highest course of ashlar (*caposaldo* 88), was determined at 162.22 m., 4.50 m. below the top of the concrete, measured from the path which crosses the bridge. Allowing 2.80 m. for the height of the *specus*, and 0.50 m. for the thickness of the intrados, the bottom of the *specus* would come at 163.42 m. Down-stream of this bridge there is a low ashlar buttress for a length of 3 m.; while the interval between the two bridges (6 m.) is partly built up with masonry and partly filled with natural rock.

There is no trace of Aqua Claudia in the west branch of the Fosso di Biserano. To judge from the position of the lumps of deposit seen on the surface of the fields, it followed the Marcia, turning slightly to the north-west and then back again to the south-west. There is a great deal of deposit in the field-walls on the hill to the east of the Laghetto di Monno or della Pallavicina, and also paving-stones belonging to a road for the service of the aqueducts. A *puteus* attributable to the Claudia, with much deposit, was situated immediately to the north of the Laghetto, at the mouth of which, north of the Marcia's bridge but at a higher level, considerable remains may be seen. On the east bank of the stream, north of the bridge, is a piece of concrete substructure; while a second substructure of Severan brick-faced concrete, with earlier *opus reticulatum* facing below, in all 79.35 m. long, strikes WSW. across the valley. The channel here was left entirely open, probably for ventilation: it was 1.20 m. in width for a depth of 2.90 m., after which it had been filled up with concrete, but had been built 0.55 m. deeper, narrowing to 0.88 m. at the bottom. On the west side of the stream a recent clearing gives a depth of 2.30 m. (II. 9). The side walls are 0.85 m. thick: the whole is supported by buttresses at an average interval of some 6 m., 1.05 m. wide and projecting from 1.85 to 2.10 m. Ten buttresses are well preserved on each side; two can be traced at the west end, and there was a large terminal one at the east end. The structure still hangs in mid-air over the stream (Fosso della Pallavicina), which once passed through a small arch between two buttresses. The lower part of the original bridge-head, about 2.60 m. wide, faced with *opus reticulatum* of *selce*, is still preserved both on the north and south sides. The east bank has been largely washed away, but a concrete face is still visible far back.

South-west of Casale della Pallavicina there is a piece of substructure¹ about 200 m. long, a little above ground-level, belonging to this same aqueduct: it originally ran straight, almost due west, but, in a Flavian or Hadrianic repair, a new *specus* replaced the original for more than half the distance, being taken off at

¹ It is wrongly referred to as Anio Novus in *Class. Rev.*, 1900, 236.

PLATE XII



a. AQUA CLAUDIA AT FOSSO DI BISERANO
(With Dr. Ashby and Miss Van Deman)



b. AQUAE CLAUDIA-ANIO NOVUS : FROM CAPANNELLE TO TOR FISCALE

right angles, with another right-angled turn to get it back into the line. At the second turn a huge buttress filling the angle was removed for the passage of the farm road. The original construction was in *opus reticulatum* outside, and rough concrete inside the *specus*, which is round-topped, 1.16 m. wide, with side-walls each 0.95 m. thick. The facing of the later channel is of *opus reticulatum* with brick and tufa blocks outside, and of brick inside. There are external buttresses at rare intervals. The floor of the *specus* is at 157.93 m. (*caposaldo* 81: II. 8'). It was the news that this piece of aqueduct had been discovered by being broken through by the farm road that first directed Lanciani's attention to the possibility of recovering the course of the aqueducts in this district, where no remains of them had hitherto been known.

The aqueduct now seems to have run almost due south towards the Fontanile di Valle Ginestra, taking then the same line as the Anio Novus, and both works subsequently keep close together. There are large quantities of deposit in the region west of the fountain, but the next actual trace of the aqueduct is a bridge over the small stream immediately west of Casale delle Marmorelle. This is built of *selce* concrete, faced with *opus reticulatum* quoined in stone; a little way up the west bank may be noted a string formed of a single course of broken tiles 0.042 m. thick, with *opus reticulatum* below it and small rectangular blocks above, a rare case in the writer's experience.¹ The bridge was about 4 m. wide at the bottom, with an offset at the *specus*, and was subsequently reinforced with rough concrete, over 2 m. thick on the north side, and rather less on the south side. Originally there was only a small opening for the stream. The *specus* is traceable, the sides being visible in the path which crosses the bridge. *Caposaldo* 80 was taken, on the level of this path, at 150.91 m.,² and a small hole revealed, at 20 cm. below, what seemed to be the deposit on the bottom of the *specus*; the true level of the channel may thus be computed at about 150.50 m., allowing 0.21 m. more for the thickness of the deposit itself.

In the next valley to the west, which descends NNW. from the railway station of Monte Compatri-Colonna, and in the vineyards of Casale Mattia, there is a much longer fragment of substructure, measuring some 60 m., with eight buttresses. Only the north wall is visible, for the earth has accumulated on the south side, and a level terrace has thus been formed, extending to the Anio Novus, some 35 m. away. The construction is of concrete faced with *opus reticulatum* in *selce* with quoins of the same material, and the five largest intervals between the buttresses have arches

¹ It belongs to the original construction, according to Dr. Van Deman.

² In *Livellazione* it is wrongly attributed to the Anio Novus, and entered as I. 13.

of fine tile-work. A stream runs through the largest interval of all, over the arch. After a buttress 2.20 m. wide, to the east, there is an arch 3.78 m. in span, coming 1.75 m. short of the next buttress, 1.79 m. wide. In the Hadrianic period the arches were filled with a mass of concrete, 0.75 m. thick, faced with *opus reticulatum* of the good, hard, local tufa. West of the stream very little is preserved, but the foundations are exposed for some 10 m. The cement bottom of the *specus* remains, with nothing of the walls, at 148.69 m. above sea-level (*caposaldo* 77), only 0.58 m. below that of the Anio Novus.

There is much deposit at the north end of the district called Il Quarticciolo, and farther west still, in the Regione Forma Rotta,¹ not only is deposit very plentiful, but fragments of *selce* from the *specus* or *putei* are found in cultivation. On the east side of Colle Trugli, south of the *Ruderi* at point 147, at about 145 m. above sea-level,² the channel of the Claudia is running 10° N. of W., being round topped, and 1.08 m. wide. In the deep Fosso di Fontana Candida, on the west of this hill, there is much deposit, and a rock-cut shaft 0.70 m. in diameter, with footholes, may also be seen on the next hill.

The aqueduct now reaches the broad Valle di Prata Porci,³ where there is a bridge a little north of point 145, crossing the deep narrow stream-bed, which runs through the centre of the basin, just below the confluence of its two branches. This is an original bridge, a single-arched structure, about 6 m. wide, of concrete faced with tufa *opus reticulatum* quoined in tufa. Some very late additions were faced with brickwork⁴ and *opus mixtum*.

The deposit⁵ to the west of the bridge may belong to either aqueduct; for in the stretch between here and the next stream, the Aqua Claudia must have passed under the Anio Novus and run to the south of it as far as Acqua Acetosa.⁶ West-south-west of point 142 this stream, the so-called Fosso della Morte, runs first for about 50 m. over the base of the *specus* of Aqua Claudia, full of deposit, and then follows it through a cutting, which soon becomes a tunnel about 90 m. long. This is marked as *cuniculus* by Ameti in his map of Latium (1693), though he did not know

¹ PBSR. i. 249.

² It is not included in *Livellazione*.

³ PBSR. i. 244.

⁴ One bearing the fragmentary stamp, ASI PONT (2nd century).

⁵ Nibby (*Schede*, i. 113) remarks that the whole floor of the basin of Prata Porci, and the hills adjacent as far as Pantano Secco, are scattered with fragments of a calcareous deposit, stratified, and similar to that left in its *specus* by the Aqua Claudia: and on his plan (F) he marks the bottom of the *specus* of one of the aqueducts. But he did not see that this threw light on the course, and we ourselves at first mistook (*Rendic. Linc.* 5. vii (1898), 126: PBSR. v. 321) the true nature of this deposit. In his published works (*Analisi*, iii. 10) he does not speak of it at all.

⁶ In the map the point where the aqueducts cross is wrongly placed near the Fontanile Trasanella. The *capisaldi* are rightly placed, but II. 8 belongs to 66, 64, and 63, and I. 10 to 65 and 62.

its real nature, which was first pointed out by Lanciani.¹ It was cut in the rock to a height of 3.55 m. at the east end and to a width of 2.30 m., and was then lined with concrete.² At the upper end, where it runs due west, the *specus* is 2.86 m. high and 1.10 m. wide;³ and runs south-west by west. The stream has worked through the bottom of the *specus*, cutting through a hard bed of rock to softer material, and creating a whirlpool some 3 m. deep. About the middle of the tunnel is a circular *puteus* of concrete, now 1.20 m. in diameter, but originally smaller: and at the west mouth is an older rock-cut drain which the aqueduct has cut at right angles, blocking it with the concrete of the *specus*. There was a considerable drop in level in this tunnel. *Caposaldo* 66, at the upper end, gives the bottom of the *specus* at 141.90—5.80 = 136.10 m.; while, at the lower end, *caposaldo* 63 gives it as 132.63 + 1.97 = 134.60 m. (II. 8). This is a fall of 1.50 in about 90 m. or 1.35%, which is continued to the next point where the *specus* is visible, on the west bank of the west branch of the stream. Here it is running 30° S. of W., with turns no doubt introduced to break speed in this rapid fall. It is a concrete *specus*, placed in a cutting in the rock, with a present height of 1.96 m. and a width of 1.47 m., diminishing rapidly to 0.95 m. at the bottom: the side walls are 0.44 m. thick, and the vault 0.80 m. thick, but the concrete here is Severan. The intrados is at 136.56 (*caposaldo* 64, fig. 15),⁴ the bottom being concealed with thick deposit; assuming a height of 2.65 m., as at *caposaldo* 63, the bottom would be at 133.91 m. above sea-level.

Deposit is present in very large quantities on the east bank of the extinct crater of Pantano Secco and in the crater basin itself. Both aqueducts must have passed along its south side just below ground level, probably in cuttings filled with concrete.⁵

In the eastern branch of Fosso del Cavaliere, about 100 yards south of the path, the concrete foundations of a small bridge may be seen in the west bank of the stream. The aqueduct ran south-west, and the concrete (of the original period) was faced with *opus reticulatum* of *selce*. The deposit at the bottom of the *specus*⁶

¹ *Bull. Com.*, 1905, 293.

² This, as far as preserved, belongs to the original period, according to Dr. Van Deman.

³ *Livellazione*, p. 27, fig. 14.

⁴ In the text of *Livellazione*, *levante* is an error for *occidente* and *capisaldi* 63 and 64, with their corresponding figures, have been reversed. Their position is also wrongly indicated in the map, as both are on the line of Aqua Claudia, as well as *caposaldo* 66; whereas 62 and 65 belong to the Anio Novus. To the south of the tunnel are the remains of a large villa (*PBSR*. i. 243).

⁵ Nibby speaks of finding an aqueduct following the east side of the lower platform of the villa on the west bank of Pantano Secco; but to what he refers is uncertain. *Analisi*, i. 107 *fin*.

⁶ *Livellazione*, i. 8 (129.009 m.). The existence of traces of a *puteus* close to the path shows that this bridge cannot be attributed to the Anio Novus, but must belong to the

is visible. Valle Lupara, traversed by a rapid stream in a narrow deep bed, may also contain traces of a bridge, but thick brush-wood obscures all. There is much deposit in the vineyard on the west-south-west edge of the Macchia della Sterpara, south of Casamara; in the west branch of Fosso del Cavaliere, which passes east of the house named Santangeli; and close to and south-west of the Fontanile Vermicino. There is a considerable drop in level here, and, as on the Anio Novus, underground cisterns or clearing-tanks are suggested by the fact that the aqueduct does not appear above ground.

The aqueduct crossed the small stream west of Fontanile Vermicino some 150 m. SSE. of the Anio Novus, as the deposit shows. Here the writer saw a tufa *cippus* of the usual type, with a circular hole in it, above which it is preserved for a height of 0.48 m. There is no trace of an inscription: indeed, all existing *cippi* of Aquae Claudia and Anio Novus seem to be uninscribed. A shaft 1.00 m. in diameter, cut in the rock on the next hill-top, might be a *puteus*. The deposit indicates that the aqueduct crossed the next stream¹ about 100 m. south of point 112: and the existence of much deposit south of the *putei* of the Anio Novus, presently to be described,² defines the line of the aqueduct as far as the valley of Marrana Mariana. There is little deposit east of the Marrana; but in the valley the *specus* occurs once more. It has for centuries served to bring the water of the Acqua Acetosa to the fountain of Tenuta di Casal Moreno, to the north of the huge Roman villa called Centroni.³ During a recent reconstruction of the channel, a *puteus* was brought to light some 100 m. to the east. It was circular, 0.90 m. in internal diameter, with walls 0.60 m. thick, and was faced with *opus reticulatum* inside and out. The *specus* as seen at the fountain is lined with rough concrete (II. 7: *caposaldo* 44).⁴ The character of the deposit is that of the Aqua Claudia. The walls are each 0.78 m. thick; and the external facing is of *opus reticulatum*, while a lateral buttress is faced with small rectangular blocks of tufa.

The Claudia now entered a tunnel, later used by Calixtus II for the Acqua Marrana.⁵ The *puteus* at the ESE. end is in part

Claudia, which in this portion of its course ran to the south of the Anio Novus: and repeated examination has also convinced me that we have here to do with the bottom, and not the intrados, of the *specus*.

¹ In this stream the two branches of which meet at the point marked 112 m. above sea-level, there are traces in each branch of a channel which I formerly thought (see *Builder*, 204) to be the *specus* of the Claudia, but which is, I am now convinced, a construction of later date. Much aqueduct deposit is used in its construction.

² *Infra*, p. 296.

³ *PBSR.* iv. 121.

⁴ This is about 100 m. (not 400) east of the new *casale* at point 111, wrongly referred to as Casal Moreno in *Livellazione*.

⁵ *PBSR.* iv. 41, 118. Fabretti (150: 143) wrongly attributed it to the Aqua Crabra,

preserved, and enough of it can be seen to show that it was circular and of *opus reticulatum*; but the interior has been rebuilt and is now square. The other *putei* have all been altered, though it can be seen in some cases that they were originally round. The intervals are irregular, varying from 74.40 m. (249 Roman ft.) to 77.50 m. (259 Roman ft.). The direction is first a little north of west; but, after the road has crossed it, parallel to the road and to the ancient Via Latina, that is, almost north-west. The tunnel is 940 m. long,¹ and the Acqua Acetosa not more than 100 m. farther east. The Anio Novus must have taken advantage of this drop to cross the tunnel shortly before its present exit and thus regain its normal position in relation to the Aqua Claudia. After the tunnel the Marrana turned west again, and is now an open stream; but it still continues to run in the *specus* of the aqueduct: and traces of ancient construction in concrete are visible about a mile farther west, some 250 m. east of the embankment of the disused railway to Naples, and again in the channel after it has turned north-west.

(g) *The Branch to the Villa of the Quintilii. Map 2.*

The levels show that the divergence of the branch-aqueduct to the Villa of the Quintilii must be placed considerably farther upstream than in the map: and the deposit found in the villa itself makes it clear that Aqua Claudia, and not the Anio Novus, is in question.² The level of the bottom of its *specus*, immediately south-west of Via Appia Nuova, is at 93.80 m. Thus, as Lanciani points out,³ not only as much as possible must be allowed for erosion of the bottom of the *specus* of the Claudia by the Marrana, but, unless there was a siphon, as is most unlikely, the branch must have left the Claudia considerably to the east of the point where the Marrana now turns to run north-west, at a level of only 87 m. Its course was probably WSW., starting not far from

but rightly considered it ancient (cf. 137; Diss. iii., tab. 1, no. 25). Lanciani had at first thought it to be entirely a work of Calixtus II: Tomassetti (*Bull. Com.*, 1893, 71) had considered it to be in part ancient, but in the main medieval (Lanciani, *Bull. Com.*, 1905, 292, modified his opinion meanwhile) but changed his opinion to the correct one (*Campagna Romana*, iv. 157; cf. Lais, op. cit. 20).

¹ Lanciani, 114: 326, makes it 940 m. long, 2.20 m. wide, 1.60 m. high, with ten shafts (for the section see his pl. vii. fig. 7): but its excessive width is due to subsequent transformations, and some of the *putei* show traces of having been originally 1.30 m. square, which shows their ancient origin (*Bull. Com.*, cit.).

² It certainly is not a branch of Aqua Iulia, as Lanciani thought (184: 396), followed by De Montauzan (348); though he himself notes that, had those who conducted the excavations of 1789-91 at the villa troubled to notice the character of the deposit, the question could easily have been decided. Still less did it run into Rome, as Fabretti (154: 147) and Parker (*Aqueducts*, 133) thought, considering it to be one of the fourteen aqueducts mentioned by Procopius.

³ Lanciani, 182: 394. The ground-level at the highest point of the arches is 82 m.

the point where a *puteus* of the Anio Novus is indicated on the map, keeping more or less at ground-level until it approached Tor di Mezza Via di Albano, where the level drops and it would of necessity have been carried on arches. This aqueduct is not preserved at all on the north-east of Via Appia Nuova, and must have been destroyed for building material in the Tenuta di Tor Mezza Via; on the south-west of the road, in Tenuta Selcia, which belonged to S. Maria Nuova, it is well preserved: and this has been the state of affairs as far back as our records run.

The existing arches are estimated by Lanciani to be about 720 m. long, and to reach a maximum height of 13 m. The piers are of concrete, made with pieces of *selce* and *peperino*, faced with brickwork of the period of Commodus; they measure 1.50 m. wide and 1.49–1.75 m. long. The span of the arches varies from 2.30 m. to 2.90 m. One hundred and fifty arches can in all be traced, three main groups of fifty-nine, thirty, and twenty-eight being actually preserved. At the end of the arches the aqueduct reaches the eastern slope of the lava-stream on which the old Via Appia is carried into Rome.

From Tor di Selce the branch runs underground as far as the Villa, where no trace can be seen until it appears on the south-west side of the garden,¹ a distance of about 1,750 m.² Two brick stamps belonging to this section within the villa are recorded.³ The height of the channel here must be about 85 m. above sea-level; and it appears to end at this villa without serving to supply any other property.⁴

(h) *Capannelle to Rome Aqua Claudia-Anio Novus. Maps 2, 1.*

Frontinus assigns to the course of the Aqua Claudia and Anio Novus, where they run together, 609 paces (900.71 m.) on

¹ No. 23 on my plan of the villa (see *Ausonia*, iv (1909), 48 ff.).

² Lanciani, 182 : 394 (where 17,50 is an obvious misprint).

³ *CIL*. xv. 708.6.28. (about A.D. 138); and another of A.D. 162 recorded by Fea (*Prodromo*, 13; *Fasti*, 118), which I cannot find in *CIL*.

⁴ Fabretti wrongly takes it to Rome, though later (156 : 149) he qualifies his statement by saying 'Romam utrumque hunc ductum [he is referring to the *Aqua forsan Argentiana*: cf. *PBSR*. iv. 140, 146] aquam detulisse equidem mihi persuadeo, sed tamen inter moenia urbis receptos fuisse, non assero; quia praesertim, prior ille, qui per dorsum Viae Appiae descendit, Vallem Almonis satis profundam non nisi plurimo opere arcuato superare potuisset, cuius vel rudera aliqua, ex longa, firmaque structura saltem remansissent'. But in reviewing Kircher's *Latium*, he says: 'This aqueduct is on the left of the traveller on the Via Appia, entering the earth near the hippodrome which is to be seen in the farm of Statuario, a little nearer Rome than Casale Rotondo; a place which is famous for my having been taken for a treasure-hunter, and for the rapid flight of Marco Polo (F.'s horse), although more heavily loaded than usual with a bas-relief found in the ruins, which we believe to be those of the temple of Hercules. This aqueduct, however, did not convey water to Rome, but to the above-mentioned villa of Statuario, the owner of which we are trying to determine, but this is not the place to say it' (*Diss. accad. Cortona*, iii. 222). He marks (137 : 130; *Diss.* iii, tab. i, 22) 'aedificium ad eandem viam (Appiam) in Theatri

substructures and 6491 (9600·18 m.) on arches. Lanciani,¹ by measuring back 9,600·18 m. from the terminal *castellum* of the two aqueducts in Vigna Belardi, determined a point 1,070 m. from the Casale della Posticciola² towards Marino as that at which the arches gave way to substructures,³ at 81 m. above sea-level: while he put the start of the substructures 900 m. farther on, 450 m. north-west of Casale La Pignola, at 93 m. above sea-level.⁴ The true starting-point is, however, at least 450 m. farther north-west, well across the Marrana, which is, as Map 2 will show, over 600 m. from La Pignola. Frontinus' measurements thus appear to be excessive: for the *castellum* was 265 m. from the Porta Maggiore, and 9,335 m. from that point takes us a good deal too far. From the Porta Maggiore to the first point levelled on the Anio Novus (I. 1) is about 3,150 m., and from there to the beginning of the long stretch of arches (I. 4) 5,450 m. more, giving a total of only 8,600 m. instead of 9,335. Even if the further 375 m., to the clearing-tank of the Anio Novus (I. 5), were added, there would still be 360 m. too much. The 609 paces on substructures (900·71 m.) are just as excessive, for they should only comprise the 375 m. just mentioned, though that figure, estimated by Corbellini, should probably be nearer 500.⁵ The discoveries of 1884 and 1887 presently to be mentioned have put a different complexion on the whole matter.⁶

There are large quantities of deposit in the south-eastern portion of the Villa Bertone: but the first remains that now rise above the ground-level lie on the western edge of the drive, just to the east of the Marrana. These are the concrete of the upper part of the *specus* of the Anio Novus, which the making of the drive must have considerably destroyed; but more is to be seen on the north-east of it in a turnip field, where, in 1902 and again in 1927, I saw the rounded intrados of the original *specus*: on the

speciem (Ausonia, IV, tav. i, ii, no. 11) ubi arcus ductus quem Septimianum credimus (this is wrong) finiuntur; cf. 155: 148, where he states that it is about 25 feet above the level of the *specus* of the Aqua Claudia (at Capannelle), but wrongly says that it goes on to Rome, having seen what he believes to be traces of it between the third and fourth mile on the west of the Via Appia near the tomb of S. Urbano, then called the Torrone dei Borgiani (*Diss. acc. Pont. 2. x. i. 58*). I have never seen anything of the kind there myself.

¹ Lanciani, 145: 357.

² It must have been about 100 m. north-west of the railway-station of Capannelle.

³ In this passage he is, of course, working back upstream.

⁴ 'They are', he says, 'in fact preserved; in part they have led to the formation of a bank which would almost seem to be natural, if ashlar blocks and pieces of deposit did not project from the soil.'

⁵ There is (south-east of I. 4) a stretch of about 80 m. in which there are four very low arches, which might really be counted to either; but it does not affect the main issue, as it in any case forms part of the 375 (or 500) m. of which we have spoken.

⁶ It is now clear that the *piscina* described by Fabretti, 126: 114; *Diss. ii, tav. xviii*, had nothing to do with either aqueduct: cf. *PBSR. iv. 148*, and *Builder, 204*; cf. Fabretti, *Diss. iii, tab. 1, no. 24*.

former occasion the cement facing of the extrados was visible, the inner side of the *specus* walls being unfaced. The direction has by this time changed from 20° W. to 5° E. of N. At this point the top of the intrados of the *specus* is 80.948 m. above sea-level (*caposaldo* 40), and, allowing its height to be 1.82 m., the bottom would be at 79.128 m.

Some 25 m. north of this spot lies the settling-tank of the Anio Novus *intra septimum milliarium*,¹ discovered in 1884.² It is described as 'forming a rectangle of 21.60 by 8.90 m., with side walls 1.20 m. thick, built of concrete of chips of *selce* with brick facing outside. The reservoir³ is divided into two chambers, the smaller towards Rome, measuring 6.00 by 6.70 m.; the larger, towards Marino, 12.00 by 6.70 m. Both are full of calcareous pebbles, completely round and so small that they seem to be pellets. These pebbles, no doubt, come from the Simbruine mountains, and must have been transported thus far and rounded by the stream of the Anio Novus'.⁴ The outer wall of the reservoir on the east, which has been cleared since 1884, is built, in its lower portion, of large rough *opus reticulatum* of the original period, the brickwork, which is very bad, being certainly a later addition. The exterior of the wall was cemented over. The interior is now almost entirely filled up, and very little below the spring of the vaulted roof can be seen.

The settling-tank is only some 50 m. east of Villa Bertone: and a long stretch of the *specus* of both the Anio Novus and the Claudia was found and destroyed in 1887 in making the avenue which leads north-west from this villa⁵ to the railway-station of

¹ The seventh milestone of the Via Latina is about 1,300 m. due east of the Villa Bertone. The position of the settling-tank is correctly marked in Map I, in *PBSR*, iv, but quite wrongly in our Map 2, where it is placed north-west of the Villa.

² Lanciani, *Not. Scavi*, 1884, 155; cf. *BUILDER*, 204.

³ 6.50 should probably be read in both cases, though 6.70 will be found in *Sched. Vat.* 37, f. 97.

⁴ Cf. *Herschel*, 199: some of the pebbles were preserved in the Magazzino Archeologico, Rome, near the Colosseum. The description continues as follows: 'The mound on which the Villa Bertone has been built is artificial, and owes its origin to the refuse of the clearing tank of the Anio Novus. The deposit left by this water at the bottom of the tank is of two kinds—perfectly circular pebbles, not larger than ordinary pellets, and yellowish sand. The perfectly spherical form and the small size is explained if we consider the long distance they had to travel from Nero's lake at Subiaco to the seventh mile of the Via Latina, being rolled all the time on the rough bottom of the channel; while the presence of the yellowish sand shows that when there were violent rains in the wild gorges of the Simbruine mountains, that not even the clearing basin, or rather the three clearing basins, of Nero succeeded in purifying its water. These two materials, sand and pebbles, accumulated round the clearing tank at the seventh mile in such quantities that with the sand Cav. Bertone was able to make plaster for six or seven buildings on his farm, without appearing to diminish the quantity of deposit, while with the second he has gravelled about a kilometre of avenues.'

⁵ This villa is already 625 m. to the north-west of the point fixed by Lanciani (following Frontinus) for the commencement of the arches: but even the piece of aqueduct which we are about to describe cannot be called anything else but a substructure.

Capannelle.¹ About 120 m. from the Villa a stretch of about 60 m. of both original *specus* is preserved, though only the cover-slab of the Claudia now emerges above ground, except on the south-west side; where the exterior of its *specus* wall in cut stone can be seen in the ditch which runs parallel to the avenue. The Claudia, according to Lanciani's drawings,² was in fact almost entirely below ground. Its bottom slabs (of *peperino*) were 3.19 m. in breadth and as a rule 0.59 m. thick; but Lanciani states that one which he measured (which was not one of the largest) was 0.955 m. wide and 0.435 m. thick.³ Upon them rested the lateral walls of the *specus*, in three courses of tufa blocks, with a total height of 1.78 m., less the thickness of 0.15 m. of the bed of cement at the bottom, making the effective height about 1.63 m. The cover-slabs were also 0.59 m. thick. Above them, as may still be seen, there was a layer of *selce* concrete 0.52 m. thick, and then a layer of cement about 0.18 m. thick, which formed the bottom of the *specus* of the Anio Novus. Its side-walls were 0.75 m. thick, faced with brickwork for a height of 0.83 m.⁴ and with *opus reticulatum* above that: they were lined with cement 0.04 m. thick and the *specus* was 1.05 m. wide. An interval of about 150 m. follows, in which the *specus* has been destroyed, before the road turns down near the chapel to the Osteria close to the station of Capannelle. Just at the turn both the *specus* are again seen; but here the side-walls of the Claudia are of concrete, which seems to have been unfaced on either side, being laid in trenches, between which the earth was later removed to form the channel, and the cover-slabs superimposed.⁵ The *specus* is 1.10 m. wide (without the cement lining); while the *peperino* cover-slab which rests upon the concrete walls is 0.47 m. thick, and the measurements of the Anio Novus are the same as before. The two *specus* continue to be preserved and form the north-east boundary of the racing-stables for a length of some 200 m.⁶

Almost immediately after the new road between Via Appia Nuova and Via Tuscolana, which passes 200 m. north of the

¹ See the plan in *Not. Scavi*, 1887, 558, and cf. Lanciani, *Destruction of Ancient Rome*, 85, where it is stated that three or four hundred feet were destroyed.

² A section and elevation in *Not. Scavi*, *cit.* 559: cf. also the drawing in *Sched. Vat.* 37, f. 47, which shows the north-west end of this stretch as it is at present.

³ These measurements are reversed in *Not. Scavi*, *cit.*, but correctly given.

⁴ Near *caposaldo* 37; fourteen courses of brickwork make up this height.

⁵ Dr. Van Deman's analysis.

⁶ 'Scuderie Merolli' on the map. In part of this stretch there is some very late restoration on the north-east. Lanciani (*Sched. Vat.* 37, f. 98) has a drawing of the *specus* of the Anio Novus at the north-west end of this stretch, where the stables are actually built against the *specus*, which presents no difference from what we have already noticed, except that the strata of deposit here have a total thickness of 0.50 m.

railway-station of Capannelle, the Aqua Claudia begins to run on arches. At first there are two small ones close to the road, and then follows a small knoll in which the voussoirs of two more are seen; they are then buried, and there is an interval of some 20 m. before the well-known line of arches (Pl. XII *b*) begins.¹

In this interval must be placed the divergence of the branch aqueduct to the great villa of Sette Bassi.² As the level of its *specus* is at 77.34 m.,³ it must have derived its water from the Anio Novus, and not from the Claudia. The first remains begin 102.30 m. away from the Anio Novus and Claudia, and consist of a solid concrete wall 54.80 m. long,⁴ 0.90 m. thick, pierced in places by arched openings 2.35 m. wide, at intervals of 2.80 m. the bottom of the arches being 2.20 m. above ground-level. It is faced with *opus mixtum*, partly of alternate courses of brick and small rectangular blocks of tufa, and partly of bands of bricks and bands of blocks of tufa or *peperino*, at intervals varying from 0.25 to 1.70 m. The fronts of the arches are entirely formed of half-bricks 0.297 m. in length. Lanciani, from whom this description is taken, considers that it dates from the end of the third or the beginning of the fourth century, and was largely restored in the fifth century, to which would belong the rough reinforcing walls, 0.60 m. thick.⁵

The main aqueduct now runs on the splendid line (Pl. XII *b*) of arches as far as Casale Roma Vecchia, a distance of about 1,375 m. Lanciani's description⁶ is so good as to deserve quotation here, with certain minor additions. 'The first stretch of arches,' he says, 'between the clearing-tanks and Casale Roma Vecchia, consists of 155 piers and 154 entire arches.⁷ The piers are 3.35 m. wide and 3.10 m. thick: but the lowest course of blocks at the ground-level serves as a base and projects 0.15 m. farther. The height of the blocks is not constant, and varies from 0.55 to 0.75 m., the average of 29 measures being 0.658 m. The length also varies: I measured one which is the full length of the thickness of the pillar, i.e. 3.10 m. The distance from pier to pier is 5.60 m.; the height of the arches varies according to the slope of the ground, the first being less than a metre high, and the

¹ Owing to my inability to identify *caposaldo* 39, I have been unable to obtain any levels on this stretch of the two aqueducts. The level at Capannelle railway station is 72.17 m.

² Lanciani, *Mélanges de l'école française*, xi (1891), 172; and *PBSR.* iv. 110.

³ *Livellazione*, p. 21, fig. 10. I had already pointed out that the foulness of the deposit in the terminal *piscina* would seem to show that this was the case, as Fabretti (167: 159) had thought.

⁴ The fall from the Anio Novus (I. 4) is thus 77.66-77.34 or 0.32 m. in 157.10 m., or 2.03‰.

⁵ As I have already noted in *PBSR. cit.* from which this passage is taken, Lanciani noted a brick stamp of Marcus or Commodus, and I, one of about A.D. 140 (*CIL.* xv. 533a. 616).

⁶ *Lanciani*, 246: 358.

⁷ I counted 153 arches, not including four small ones close to the new road.

last 6.58 m.¹ The piers have a cornice 0.35 m. high, serving as an impost to the archivolt, which consist of a single ring of blocks. The whole construction above the impost cornice is narrower than the piers; these, as I said, are 3.10 m. thick, while the arches and the two *specus* are 2.52 m. thick. Every² eleventh² pier is reinforced by two buttresses, at right angles to the axis of the aqueduct, 1.30 m. thick, with a projection of 1.50 m. These measurements, however, decrease as the height decreases; near the upper end of the arches, the buttresses are only 0.35 m. thick, with a projection of 1.20 m.³ They also increase in size as the arches grow higher, for at the end of the third group of twenty arches the buttress on the south side was 1.40 m. thick, with a projection of 2.10 m. They belong to the original construction, for they have the same impost cornice as the piers. As a rule the whole construction is of *peperino*; sometimes, though I do not know why, a few blocks of tufa are inserted; while in some piers there may be one course of tufa to nine of *peperino*. Only three piers of the whole 155 are entirely of tufa (see his Pl. vii, figs. 9, 10).

'The *specus* of the Claudia rests upon a fillet which crowns the archivolt: the sides are' 1.79 m. 'high³ and 0.65 m. thick: it is 1.10 m. wide. The *specus* of the Anio Novus,' which is 1.14 m. wide, and 1.25 m. high to the spring of the concrete vault, 'rests upon a similar fillet which is 0.40 m. thick with a bed of concrete 0.45 m. thick on it, before we reach the cement at the bottom of the *specus*: the side walls are of concrete faced with brickwork below and *opus reticulatum* above on the outside,' and lined with brick up to the spring of the vault on the inside. 'Both *specus* are lined with hydraulic cement, 0.15 m. thick at the bottom and 0.06 m. at the sides.'⁴ The interval between the bottom of the Anio Novus and the intrados of the Claudia is thus about 1.00 m. From Casale Roma Vecchia, which lies about 100 m. north-east of *caposaldo* 29, a branch road runs south-west to Via Appia Nuova, reaching it at the Osteria delle Capannelle, where the Via Appia Pignatelli also joins it. This branch passes through the last arch but two⁵ of the long stretch which we have been

¹ It should be noticed that whereas the fall on these arches in a length of 2,625 m. is 5.22 m. (or 1.98‰) between *caposaldo* 37 and *caposaldo* 25 (II. 6 and II. 5 on the map: see Liv. p. 76 *init.*), the ground is falling a good deal more rapidly, which accounts for the gradual increase in height. At II. 6 the floor is at 75.00 m.; 69.78 at II. 5.

² Lanciani says 'every thirteenth': but according to our count, the arches, with very few exceptions, fall into groups of tens and twenties. There seem too to be heaps of deposit at every tenth arch, which would give the approximate position of the man-holes from which the upper *specus* was cleaned, but it does not seem as though they could be related to the buttresses, as they do not occur at the same points.

³ The text gives 1.97 m. but I suspect a misprint.

⁴ Lanciani's general attribution of the restorations to Severus, which followed, requires modification, as Dr. Van Deman will point out in detail.

⁵ Lanciani's third arch (shown in his illustration Tav. vii, 9 a, Arco III).

describing. The remains now become more fragmentary, and for about 150 m. only pieces of the late brick filling of vanished arches are preserved, excepting one fine arch near the Casale, reinforced up to the spring with concrete faced with Hadrianic brickwork. A hundred metres farther on, there is a reinforced stone arch, followed by the brick reinforcing-arch of another pier; then a stone arch with double reinforcement, and a double reinforcement without the arch.

After another gap, comes a group of four arches, the first with very late filling in a double arch, and the third with a profiled impost mould. A third gap is followed by two arches, not long since part of a group of four, of which one arch has fallen since 1900. In the next gap eleven stone piers have been removed, as the excavation holes clearly show; but the late reinforcement remains in most cases. Then, just before reaching the older railway-line to Naples, six arches more,¹ with an additional pier for a seventh at the north-west end, which has recently fallen. The first and sixth arches were strengthened with a double concrete arch with brick facing, now plastered with a modern surface. The vibration of the trains is undoubtedly doing harm to these ruins; but their collapse is inevitable, failing a restoration so radical as to amount to complete rebuilding. The blocks of volcanic stone are cracked through, and their surfaces are perishing. Nothing can save them now: they have lived out their allotted time, and must fall.

When the railway² to Naples, by Cassino, was constructed in 1890, it cut across the line of Aqua Claudia, and the foundations of three piers were discovered, with one course of blocks of stone in each. The surrounding ground was composed in large measure of masses of deposit from the Anio Novus.³ After crossing the railway line,⁴ comes a group of six arches;⁵ and then, after a gap equal to two arches, fourteen arches more, which are the finest in the whole stretch, and are estimated by Lanciani to reach a height of 27.41 m. The eighth, tenth, and eleventh, and at least two more have been strengthened by double arches of brick-faced concrete at a late period: otherwise the whole group is as it was originally built (Pl. XIII *a, b*). Lanciani describes it as follows:⁶ 'the piers measure on an average 3.705 m. wide and 3.50 m. thick, and

¹ Here is *caposaldo* 27.

² This was the main line from about 1901 to 1927, when the new direct line was completed. The original line, from Rome to Ciampino, ran to the east of the aqueducts, close to the *Ruderi delle Vignacce*.

³ Lanciani, *Not. Scavi*, 1890, 13. In *Destruction*, 85, he says that the 'railway company . . . is responsible for other damage' (he has just been speaking of that done at Capannelle).

⁴ *Caposaldo* 25 is on the boundary stone of the railway property on this side of the line.

⁵ There were seven until twenty-five years back, when the south-easternmost fell, but its south-east pier is still to be seen.

⁶ Lanciani, 147 : 359; cf. Butler in *AJA*, ser. 2, v, pp. 182-5, fig. B.

PLATE XIII



a. AQUAE CLAUDIA-ANIO NOVUS, NORTH OF CASSINO-NAPLES
RAILWAY



b. AQUAE CLAUDIA-ANIO NOVUS, N. END OF ARCHES N. OF
CASSINO-NAPLES RAILWAY

are from 5.25 to 5.71 m. apart; the greatest height is 25 courses, or 16.85 m., adding to which 10.56 m. for the height of the arches, the *specus*, and the cornices, we obtain a total of 27.41 m. I measured some of the blocks and found one $2.51 \times 0.86 \times 0.62$ m., another $1.98 \times 0.99 \times 0.71$ m., and a third $2.28 \times 1.02 \times 0.64$ m., giving an average cubical content of 1.40 cu. m.' As in the arches at Roma Vecchia, tufa blocks are mixed with those of *peperino*; some piers have three or four courses of tufa and the rest of *peperino*; only one is entirely of tufa, and it is strengthened with Severan concrete. It is curious that in many parts of the aqueduct we meet with holes opened at the joints of the blocks in search of metal clamps,¹ though there were none.

As Lanciani remarks, the line taken by the aqueduct from the clearing-tanks to Rome 'was dictated by the nature of the ground. The plateau above Roma Vecchia is joined to the site of the City by a tongue or isthmus of land, forming the water-shed between the basin of the Anio on the east and that of the Tiber on the west, which has served as a bridge for all the high-level aqueducts.'

After an interval of three arches, a single arch follows, with late concrete strengthening; and then, for about ten arches on each side of Via del Quadraro, connecting Via Tuscolana and Via Appia Nuova, nothing is to be seen but some very late encasing walls of brick-faced concrete, upon which the impressions of the robbed ashlar masonry of the piers are extremely clear.² Beyond this point Aqua Claudia turned nearly at right angles, crossed Aqua Marcia (on which the Acqua Felice has been superimposed), and then turned a second time to resume more³ or less its former direction.⁴ At both these turns the stonework has been almost entirely removed except from the very first pier, though the impressions of the blocks on the interior of the later concrete encasing walls are very clear. Immediately before the first turn,

¹ Such holes are to be seen in many other buildings of ancient Rome. Whether the result was worth the labour expended is very doubtful, especially in the Colosseum, where the hard travertine had to be dealt with.

² Two of these late fillings have been drawn by Lanciani (*Sched. Vat.* 37, f. 52: 'disegno di due piloni larghi m. 4.30 con riempitura distanti uno dall'altro m. 3.90. Nell'ossatura di questo pilone, che è il 4° a monte dal bivio Tavolato vi è un canale di marmo da tetto—altro simile—lastra marmo grechetta').

³ As Lanciani rightly points out, Canina vi. 75 has completely misrepresented the real state of things.

⁴ Tomassetti, *Campagna Romana*, iv, attributes entirely to the Claudia the blocks of cut stone found in cutting the new line to Naples: 'In a rise in the ground between the Marrana and the Acqua Felice, on the right of the Via Latina, a little beyond the tower (Fiscale), which was cut for the passage of the railway, there came to light a large number of squared blocks of *sperone* of the ancient Aqua Claudia which had fallen there. We saw them still in place in March 1913 and they were afterwards partly used for the arch under the Acqua Felice, and partly ranged along the line of the cutting, where we saw them in 1918.' This may be true of some of them (those farther towards Rome that is), but others must have belonged to the Marcia.

the greater part of the concrete of the double reinforcing-arch remains, though a considerable portion of it fell in 1902.¹ The new direct railway to Naples is just at the other side of the turn, and the stone pier of the turn itself remains, with the springs of the arches in both directions, while only the encasing walls of the next arch and pier, just before the actual crossing of the Marcia, are left. Those to the south seem to be of the time of Hadrian, as would agree with the brick stamps, but the upper part of the pier, to the south of the Marcia, and the whole of the piers to the north of it have a very late, rough and bad facing.

No more remains are left until Tor Fiscale, nearly 400 m. away, though some ashlar blocks² belonging to piers were found almost under the Marrana³ when the new Naples railway was built. Before this, Lanciani had noted⁴ that 'the line of the Claudia . . . is marked by mounds which represent its piers and which now serve as the bank of the Marrana Mariana'.

Tor Fiscale is the seventeenth-century name, derived from an official of the Papal treasury,⁵ for the medieval Turris S. Iohannis (1363). The tower itself is erected over the top of the zigzag by which Aqua Claudia crossed Aqua Marcia a second time and kept its direction (Fig. 14). One arch of the original aqueduct is preserved in the north side of the tower; the others have disappeared since the seventeenth century.⁶ The bottom of the *specus* of the Claudia is 7.10 m. above that of the Marcia, and that of the Anio Novus presumably 3 m. higher, making them respectively 69.197 and 72.197 m. above sea-level. The pier of the Claudia which is built into the tower has some very late brick-faced concrete at its base, shown shaded on the plan (Fig. 14). The piers of brick and *opus reticulatum* lying to the west of the Tower, which are not in the line of either aqueduct, must have served to reinforce the turn. They have arches at two different levels and have been a very massive structure, attributable to Hadrian. The tower is sufficiently picturesque to have been frequently represented by artists: and it is worth while to cite the first of the two views (both of 1601) by William van Nieuwlandt, which shows⁷

¹ In some of the brick facing of the fallen masses, I found examples of *CIL.* xv. 314 (Trajan), 697 (not later than A.D. 123), 1241 (end of first or beginning of second century), and Dr. Van Deman found in one of the arches what was probably a fragment of *ibid.* 904 (Trajan) or 1033, (A.D. 123).

² The blocks showed no anathyrosis; there was a small quantity of lime mortar.

³ To the north-west of it, if anything, where the Marrana always seems to keep. A travertine *cippus* was also found, plain, as those of the Claudia and Anio Novus are.

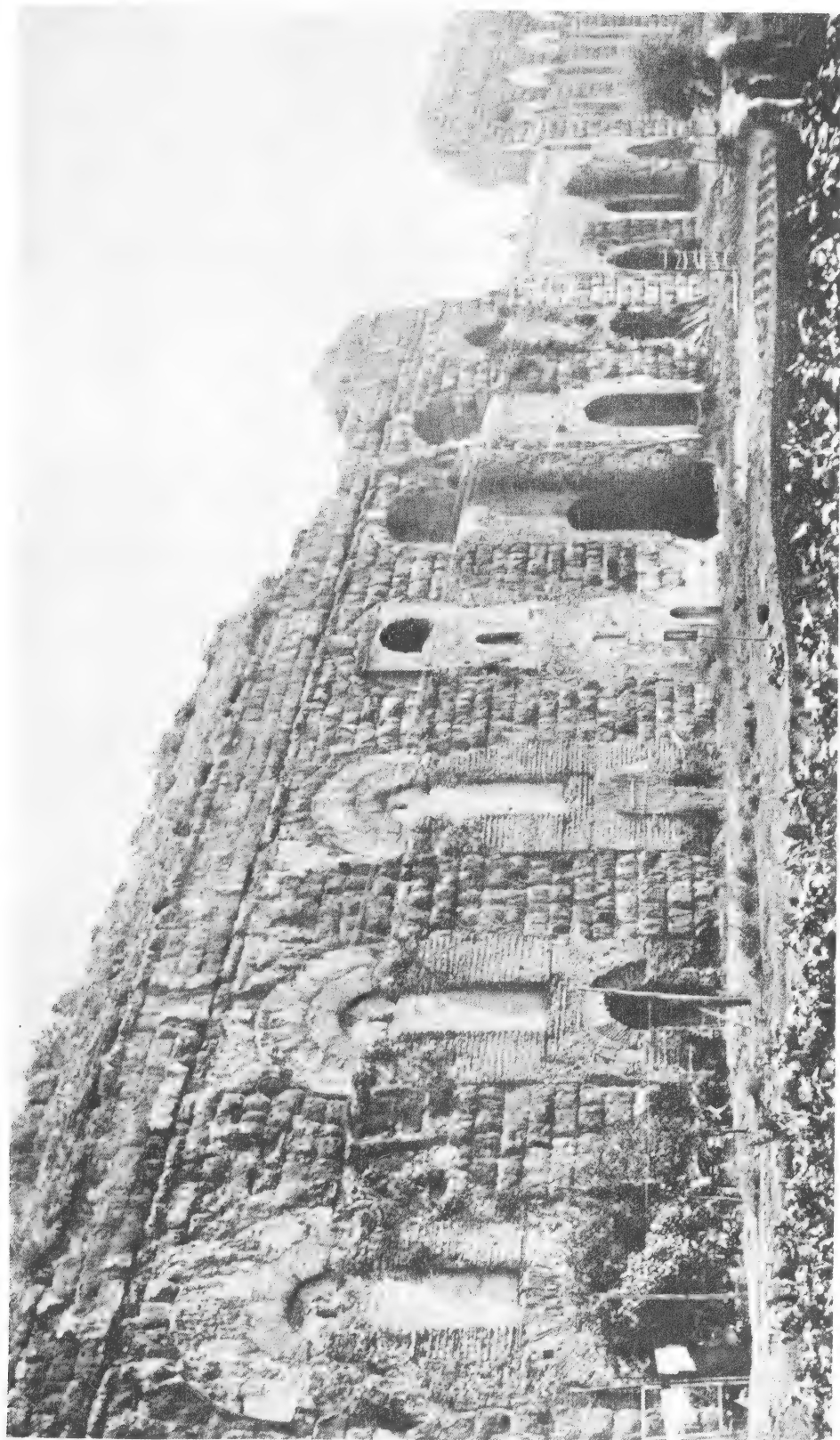
⁴ *Lanciani*, 148 : 360.

⁵ *PBSR.* iv. 70 : 79. Some papers relating to the years 1851-2, in the *Atti del Camerlengato* (Tit. iv, fasc. 3727) are of no special interest.

⁶ Parker, *Historical Photographs*, 528-32, 689, 1028, 1439.

⁷ Chatsworth, oblong green vol. (vol. 6), f. 13, f. 21. They have been engraved by Nieuwlandt himself in his *Variae Antiquitates*, 23, 24, and *Monumenta*, 6, 14; cf. Nagler,

PLATE XIV



AQUAE CLAUDIA-ANIO NOVUS, NORTH OF ALBANO RAILWAY. LOOKING EAST

remarkably fine remains of one arch before the tower and three after it.¹

Between these two double right-angled turns in the aqueduct must be placed the camp of the Goths, in A.D. 537,² as described by Procopius. 'Actual famine as well as pestilence was pressing hard upon the Romans. And the Goths, perceiving this, no longer cared to risk a decisive battle with their enemy, but they kept guard in order that nothing in future should be brought in to them. Now there are two aqueducts between the Latin and the Appian road, exceedingly high and carried for the most part³ on arches. These two aqueducts meet one another at a place fifty stades distant from Rome and for a short distance run in contrary course, for the one which previously lay to the right then continues on the left. Then they come together again, and resume their former places, thereafter remaining apart. Consequently the space between them, enclosed as it is by the aqueducts, comes to be a fortress. The barbarians walled up the lower arches of these aqueducts with stones and clay, and in that way made themselves a sort of fort; and encamping there to the number of no fewer than 7,000 men, they kept guard so that no provisions should thereafter be brought into the city by the Romans.'

The camp is wrongly stated to be close to the Via Appia, and the distance from the City should be only 30 stadia. Otherwise, the description of Procopius fits the space between the two crossings of Aqua Marcia and Aqua Claudia so perfectly that there can be no doubt as to the identity of the position, first perceived by De Rossi.⁴ Indeed, the name *Campus Barbaricus* is

Künstlerlexikon, x. 235, nos. 1-26, 31-49. In the engraving both are reversed, and there is some loss of accuracy. The two works are perhaps worth detailing as:

(1) *Variae Antiquitates Romanae sive Ruinae, ad vicum delineatae per Guilielmum van Nieulandt, anno 1618* (C. I. Visscher Excudebat); with 26 numbered plates, including the title; size 97 × 152 mm. The title-page was subsequently altered, the arrangement of the legends being changed, so as to bring in a small bird's eye view of Rome; the date disappeared, and the plates were renumbered.

(2) *Monumenta haec et Venerandae Antiquitatis vestigia . . . Wenceslao Conberghe omnis antiquitatis Admiratori et Principum Belg. Architecto Guil. Van Nieuwlandt. L.M.D.D. (Juliaen Tenier exd.)*; 19 numbered plates, not including the title; size 105 × 127 mm.

¹ For a photograph of this view see *Illustrated London News*, 9 July 1921, p. 46.

² Procopius, B.G. ii. 3. 2-7. I follow the translation in the Loeb edition; in that given in *PBSR*. iv. 72, I wrongly supposed that μηδὲν . . . ἐσκομίζοντο referred to the Goth's fear of infection from the plague, which was raging in Rome. Cf. Van Buren in *J.R.S.* 1926, 134, where, however, the statement that 'the Goths pitched their camp at the intersection of the aqueducts in order to blockade the food-supply of Rome' is not altogether clear. The camp lay between two intersections, as requires stating; for otherwise it seems curious that they should have seized any part of the aqueducts in order to blockade the food-supply.

³ This seems the best rendering of ἐπὶ πλείστον: as a fact, both aqueducts were originally entirely carried on arches in this section. The late repairs were partly 'the lower arches, τὰ κάτω κυρτώματα, and partly solid walling. Procopius therefore correctly records the state of affairs in A.D. 536.

⁴ *Bull. Crist.*, 1873, 95 ff., 1876, 35; *Roma Sott.* ii. 125.

actually applied to it in a diploma of Sergius I (687) and in the register of Gregory II,¹ though both sources speak of it as if nearer the Via Appia, *iuxta Campum Barbaricum ex corpore patrimonii Appiae*, whereas that road passed to the north-east of all the aqueducts, just beyond Tor Fiscale.

Volpaia's map² of the Campagna (1547) shows the aqueducts, especially Aqua Marcia, with only moderate accuracy, but considerably better preserved than now, almost justifying Lanciani's opinion³ that 'in 1585, when the construction of the Acquedotto Felice was decreed by Sixtus V, the series of arcades of the Marcia and of the Claudia, both seven miles long, were practically intact. . . . Upon Matteo da Castello and Domenico Fontana, the architects of Sixtus V, and upon the trustees of the Hospital of S. Giovanni, rests the main part of the responsibility for their disappearance.'

The Casale Arco Travertino, a small farm once far larger, takes its name, which first appears in 1277,⁴ from the arch of travertine blocks⁵ which must have carried Aqua Claudia over the Via Latina at this point.

In regard to the branch which Fabretti states⁶ to have left Aqua Claudia a little to the south-east of Tor Fiscale, the writer can only summarize what he has already written.⁷ Fabretti marks the work crossing the valley just above the Acqua Santa, on arches⁸ said to be 400 paces long, and following the left bank of the Almo to the so-called Grotto of Egeria, below S. Urbano. Nothing is now to be seen: nor are the arches shown by Ameti (1693) or Cingolani (1704), and their disappearance is remarkable. The remains have generally been attributed⁹ simply to a

¹ *Deusdedit* (ed. Marinucci), x. 326; *Liber Censuum*, i. 353.

² See *La Campagna romana nel tempo di Paolo III; la mappa di Eufrosino della Volpaia*, 32.

³ *Destruction of Ancient Rome*, 85, 240.

⁴ Tomassetti, op. cit. 64 ff.; *Lanciani*, 149: 361; *PBSR*, iv. 58, 60; Volpaia *cit.*, 30, 31.

⁵ *Arch. Sanct. Sanct.* IV. iv. 23, f. 44. A record of the sale by auction of the blocks of travertine from the demolition of a 'tower' in the tenuta of Roma Vecchia, in the 'quarto' of Arco Travertino, may just as well refer to a tomb as to this arch. On the other hand, there are plenty of documents relating to the sale of piers; cf. the sale of three piers recorded by Lanciani, *Storia degli scavi*, i. 40, ex *Arch. Stat. Rom. Not. Nardo de Vendettini*, prot. 785. The sales recorded in the archives of the hospital of Sancta Sanctorum, cited by Lanciani and Tomassetti (*Arch. Sanct. Sanct.* IV. iv. 47, fol. 27; 58, f. 2.), went on until comparatively recent times. In 1638 two persons had to be forbidden to remove blocks of stone by the Cardinal Chamberlain, Ippolito Aldobrandini—unless, indeed, the hospital was defending its own right to remove them, as Tomassetti suspects (*ibid.* II. x. 47). Lanciani also notes that in this stretch of the aqueduct, situated in the Silvestrelli property, the ashlar masonry was, as usual, removed in preference to the brick-faced concrete, but that sometimes the latter, which he attributes to the Flavii and Severi, was preferred, the original piers being left (149: 361).

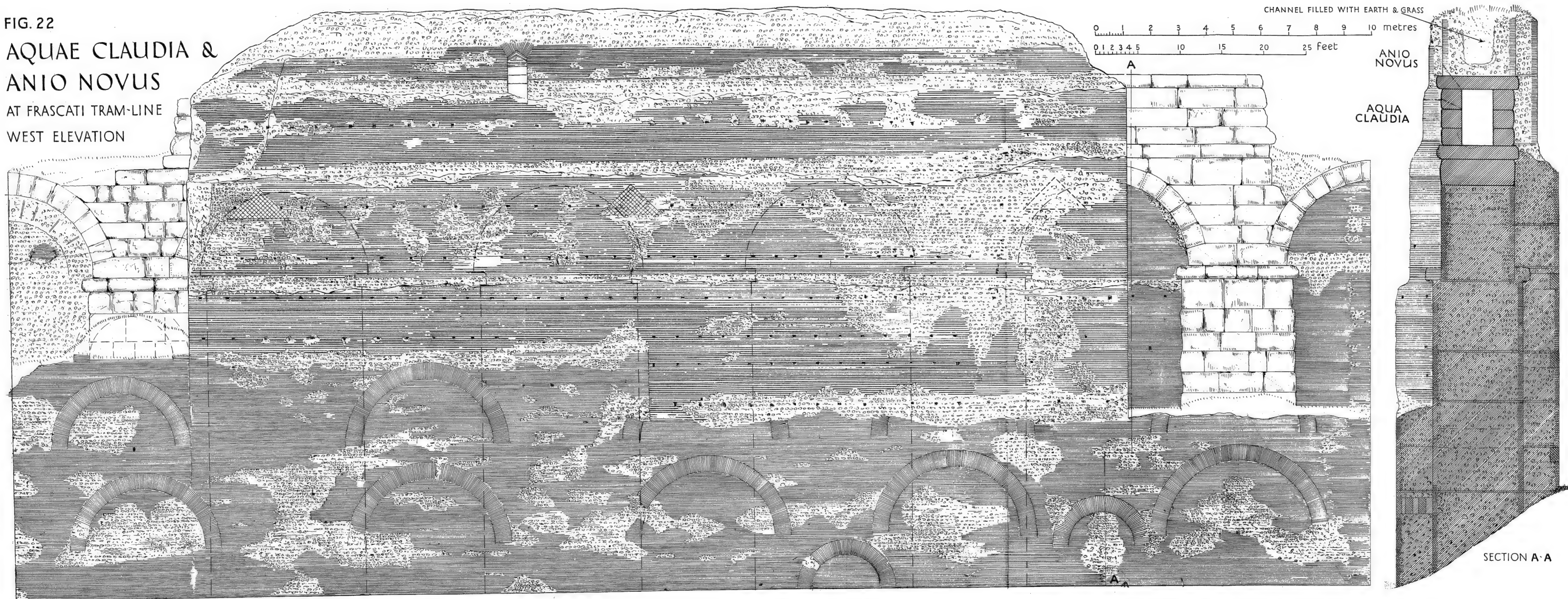
⁶ 5: 6, 137: 130; Diss. i, tab. i; Diss. iii, tab. i.

⁷ *PBSR*, iv. 82.

⁸ Cf. Lami, *Notizie storiche dell'Acqua Santa*, 47; Moretti, *Trattato medico-fisico dell'Acqua Santa*, 121 n.

⁹ Lanciani, 15: 277.

FIG. 22
AQUAE CLAUDIA &
ANIO NOVUS
AT FRASCATI TRAM-LINE
WEST ELEVATION



channel or channels which fed the so-called *nymphaeum* of Egeria. Parker,¹ however, traced the *specus* beyond this point, opposite to the so-called temple of Deus Rediculus; believing it to belong to an aqueduct which fed the Thermae of Commodus and of Severus, which he supposed, wrongly, to continue from that which supplied the Villa of the Quintilii.

Resuming now the course towards Rome, there first occur the very late encasing walls of a vanished pier; then the encasing walls of four piers, partly Hadrianic and partly late. Near the farm-house called Fattoria G. Rampa (formerly belonging to the Silvestrelli) are more piers, mostly robbed of ashlar, but retaining their encasing walls and double concrete arches in good order: the first three show mainly late restoration, but the next four exhibit very fine work of the Hadrianic period.² It may be noted that Hadrian merely underpinned, while the late restorers encased the piers also, as Hadrian did not, even when his underpinning projected beyond the piers. The stone corbels left for scaffolding are early examples of a practice more general in the third century.

After about 100 metres, two stone arches occur, both underpinned with late arches later filled;³ and then a stone pier, to which adhere a pair of very late solid reinforcements in brick-faced concrete, one containing a triangular panel of *opus reticulatum*, six cubes a side, such as we shall soon see again farther on. There are also more Hadrianic reinforcements,⁴ retaining clear impressions of the blocks which they once supported.

Hence another 350 m. takes us to the point where the Frascati tram-line passes through a gap⁵ in the aqueducts. Just north-west of this gap, a very conspicuous portion of the aqueduct has been selected for illustration (Pl. XV*a*; Fig. 22), viewed from the west because the east shows uniform work.

The original stone arches were reinforced, under Hadrian,⁶ with two tiers of brick-faced concrete arches, the uppermost provided with stone corbels for scaffolding used in repairs.⁷ In

¹ *Aqueducts*, p. 133.

² Van Deman: *Lanciani*, 147 : 359, tav. viii, figs. 2, 4, held them for Severan.

³ One is much narrowed by a very late facing of blocks of stone, which is almost post-classical.

⁴ In one of these there are a large number of fragmentary brick stamps of the time of Hadrian, several showing the date A.D. 123.

⁵ For the ancient road found at this point see *supra*, p. 136.

⁶ The periods are not in doubt. Dr. Van Deman would date them as in the text.

⁷ Unfortunately, Hadrian's work is visible only in the arch immediately under the stone arch on the extreme left, in the portion selected for the elevation, which begins in the middle of the first arch *after* the gap. The arch *at* the gap, half of which is preserved, has been reinforced at two different times, but evidently had a small opening left even at the latest period. The straight joint visible on the left of the elevation, in the lower part of the Severan reinforcement, is probably a builder's joint, marking the work of two different gangs.

the time of Severus, concrete was built under the arches of Hadrian; the older facing was cut away and replaced, a solid wall being built below, in which three tiers of prominent relieving arches have also been introduced. Still later, a massive wall, distinguished by put-log holes, was made to cover the Severan wall, cutting away some of it, including most of the second and all the third row of relieving-arches, to get a better key; it was stepped off as it approached the two *specus*; which it completely enclosed. In the facing three triangular panels of *opus reticulatum* are introduced, the left being equilateral, with 14 cubes on each side.¹ Above and to left of the central panel, a gabled opening passes through the late brick wall, probably leading into the *specus* of the Claudia.² On the east side of the aqueduct all the work may be ascribed to Severus.

Beyond this is a series of ten arches, of which the piers have been completely removed, leaving only the concrete reinforcement. The Hadrianic reinforcement is discoverable under all, and has been refaced by Severus, whose lower outer reinforcement, with its relieving arches, projects beyond the upper reinforcement, continued here, and has been broken through in order to rob the early stonework (Pl. XVa; Fig. 22). At the ninth pier, it may be noted that the upper Hadrianic arch has been filled with a solid mass of concrete faced with brick, keyed into the top of the lower arch.

The Porta Furba, erected by Sixtus V, now appears. It carries the Acqua Felice over the Via Tuscolana.³ Among many views of it may be cited one showing the fountain erected by Clement XII.⁴ Close by, the Aqua Claudia turned at right angles: its stone blocks

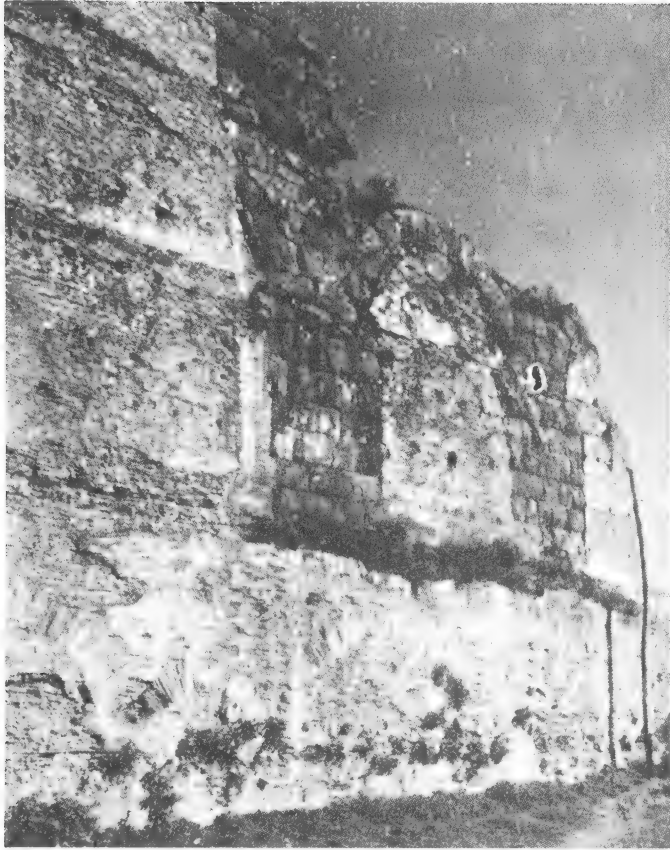
¹ We cite as a parallel the introduction of a band of three courses of this facing in the *campanile* of S. Apollinare in Classe (c. A.D. 549), at Ravenna. [Cf. also the triangular panels on the towers of Le Mans and Cologne; Blanchet, *Les Enceintes romaines de la Gaule*, p. 245, pls. v, 4-6. xiii. 2, the former at earliest third-century work. Ed.]

² De Montauzan, p. 404, fig. 130, gives a drawing of this section, but wrongly represents the core of the original piers as though it were composed of small stones: his description, too, is of a somewhat general character: 'A partir des Sévères, au III^e siècle, et surtout au IV^e, on se mit à combler entièrement les vides par des massifs de murailles, blocages formés de toute espèce de matériaux: tuiles, moellons informes, tronçons de colonnes, dalles, plaques de marbre multicolore etc.; le front enveloppé de gros blocs de travertin ou de tuf, avec revêtement extérieur de briques, renforcé du sommet à la base par des recoupes successives, surtout du côté vers lequel l'ouvrage avait subi une inclinaison. (Les renforcements sont plus épais en général du côté Est de l'aqueduc, soit du côté gauche en regardant vers Rome. Cela prouverait que l'aqueduc penchait plutôt de ce côté, et en effet les amas de ruines rencontrés du distance en distance montrent que la chute s'est faite dans ce sens presque toujours. Cela tient-il à l'influence du vent, à la nature du terrain? . . . Je ne puis le déterminer.)'

³ Orbaan, *Sixtine Rome*, 11 ff., who brings out the importance of 'one of the greatest triumphs Papal Rome has known since the Caesars . . . the re-conquest of the Hills of Rome, which had been deserted ever since the failure of the water-supply had rendered them uninhabitable.'

⁴ An engraving by Du Flos after his own drawing which is pl. 23 of the *Quinto (Secondo) libro delle fabbriche* (1739).

PLATE XV



a. AQUAE CLAUDIA-ANIO NOVUS AT THE
FRASCATI TRAM-LINE



b. AQUAE CLAUDIA-ANIO NOVUS, NORTH OF PORTA FURBA,
FROM THE SOUTH-WEST

have all been removed, including those of a large buttress at the turn; but the late filling of brick-faced concrete and a large buttress of the same type and date as that shown in Plate XVb is still preserved. Another fountain of the Acqua Felice, also dated to Clement XII, has been placed in front of it.¹

The Aqua Claudia now turns at right angles again, to resume its former direction, in the Vicolo del Mandrione: and the Acqua Felice, turning at right angles also, begins for the first time to use Aqua Claudia as a support. After a modern arch, the Acqua Felice runs upon a massive brick-faced concrete wall² erected on the north-east side of the Claudia by Septimius Severus, with arched niches³ corresponding to the stone piers. There are seven of these niches before the point *a* where our plan (Fig. 23) begins; but only four of the ashlar piers are preserved. As in the previous sector, the stone arches were supported, under Hadrian, by two-storied arches of brick-faced concrete,⁴ with stone corbels in the upper range. These works can often be seen on the north-east side behind the Severan brick facing, which covers them in a solid mass, projecting beyond the front of the aqueduct and forming an upper step to the massive wall on which the builders of the Acqua Felice set their conduit (see section CC). On the south-west side, the Severan restorers faced right across, cutting away the original facing, though without concealing all trace of earlier work: and this happens, farther along, on the north-east side also, in the first three arches after the next turn, at the ninth pier on our plan. At the turn the Acqua Felice returns to the Marcia, which its builder preferred where well enough preserved. The outer wall on the south-east of Aqua Claudia ceases here; but the unweathered blocks in buttress *b* suggest that it was once concealed by concrete, now collapsed. The arch on the turn (Pl. XVb) is also completely filled up; first and in part by a Hadrianic arch, later reinforced by two flat arches of inferior work, and completely filled up in the Severan period. Here is also the first example of the blocking of the *specus* of Aqua Claudia with concrete, while supporting the Anio Novus above it by a very late and rough wall, marked by many small squared stones in its facing (Fig. 24). In the first three arches after the turn, the double arches of Hadrian have

¹ Two views of it are given by Nieuwlandt, *Chatsworth*, vol. cit. 22, 47 = *Var. Antiq.* 20, 26 = *Monum.* 2, 8. See p. 232 n. 7 for detailed references.

² This was thought by Lanciani to be the Marcia (149 : 361). In the facing of this wall we find two different thicknesses of brick used, as in the *Thermae of Caracalla* (*J.A.*, 1912, 425). The original height of this wall is not certain, but it did not go beyond the spring of the arches, if as far. Some later patching may be attributed to Diocletian.

³ The arches have, without exception, double rows of tile voussoirs.

⁴ At point *a* there is a panel in the brick facing of the Claudia framed in tiles (outside measurement, 0.66 m. high, 0.60 m. wide). Such panels at Ostia contain street and house-signs (Calza, *Ostia*, 125, 134; cf. Richmond, *City Wall*, p. 77).

been filled up and concealed on the north-east side by Severan brick facing: and the stonework of the fourth pier has been cut back to receive a reinforcement similar to that on the other side. The next four arches show no trace of any reinforcement other than that of Severus. On the south-west side, the first arch has the usual Severan filling (section BB); and then, on the next six piers, the Severan reinforcement extends up to the level of the bottom of the *specus*, the upper part being supported on the impost-mould of the stone arches, under which the upper Hadrianic arch is left open. The alterations then alternate between Hadrian and Severus (Pl. XVI). The eighth pier from the turn has a buttress on each side: and, at the tenth, there is a stairway on the south-west side of the aqueduct, supported by two concrete piers faced with brick, cut stone, and reticulate, later reinforced in brick and reticulate: it seems to belong to the Flavian period, and to be reinforced by Hadrian.¹ The Acqua Felice now leaves Aqua Marcia, which was too far ruined to be of service, and follows Aqua Claudia into the City, tunnelling below the level of the Roman arches.

After the eleventh arch, with Severan reinforcement, begins a massive wall of late work (post-Diocletian) on the north-east. Between the sixteenth and seventeenth piers, an uninscribed *cippus* of this aqueduct was found, in 1905, on the edge of the ancient road. It measured 0.62 m. wide and 0.29 m. thick, and a line across its top marked the exact extent of the ground reserved for the aqueduct. It lay 3.58 m. from the centre of the arches.² In the late reinforcing wall the first two arches are left open, the next pair closed; in the first open arch can be seen, on the south-west side, traces of Hadrianic work, while the second exhibits work by Hadrian and Septimius Severus. After this, a footing of the period of Severus occurs on the north-east side, the filling of the arches being late work on this side, while work of Hadrian and Severus is visible on the other in the next five arches and Hadrianic in the sixth.³ Two arches follow, in which nothing but Severan reinforcement can be seen, and then comes a buttress on each side of the aqueduct, followed by two more arches in which both Hadrianic and Severan reinforcement are visible. Here the plan ends, but there are six more piers with a concrete wall of the Severan period and a later reinforcement on the north-east side. Over the last arch and pier the late wall, which supports the upper and blocks the lower *specus*, is well seen (Fig. 24) from a sketch by Mr. Newton.⁴

¹ A photograph of it is given by Herschel, p. 182.

² Lanciani, *Bull. Com.*, 1908, 291.

³ See *Illustrated London News*, 9 July, 1921, p. 47.

⁴ The deposit of the Anio Novus, resting on the cement floor of the *specus*, may be

The military road and railway to Albano now pass the Claudia at a gap of four arches. On the military road, Lanciani was able to note¹ that the ashlar piers were placed upon a foundation consisting of a rammed mass of cement, badly made with chips of *selce* and tufa. The Severan fillings of the arches rested on foundations of concrete made with chips of tufa, set on virgin earth or tufa rock. A road about 2 m. wide was found on the east. Some 20 m. farther on, when the railway was constructed, in 1890, the foundations of the piers were found to consist of concrete, on which the cut stone blocks of *sperone* rested. On the ENE. side there was a well-paved road 3.80 m. wide, 1.30 below the modern ground level. In the interval between the Claudia and the Marcia (26.40 m.) were six late tombs.²

In the property known as Podere Saccardo,³ another interesting length begins (Fig. 25). There are fifteen well-preserved arches. The second pier after the Albano railway is buttressed on both sides in masonry, later strengthened with brick-faced concrete

on the south-east: it also exhibits, on the north-west side, Hadrianic repairs in *opus reticulatum* with brick bands, extending to the arch beyond it. The arch, however, was only half-filled then: and later on a brick pier was added on the farther side, forming a high,

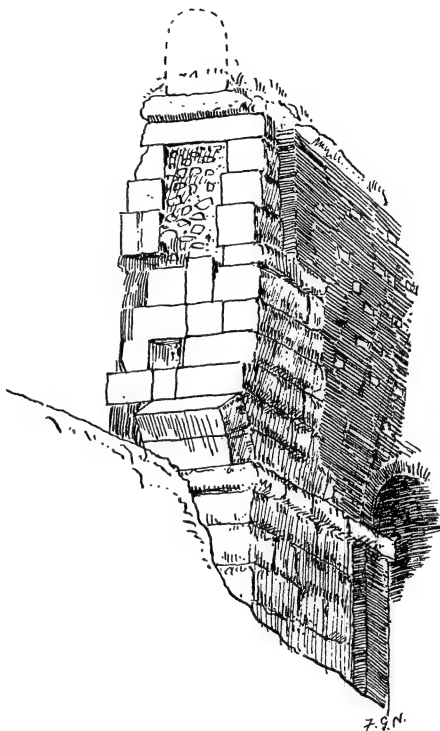


FIG. 24. Late repairs in Vicolo del Mandrione.

clearly seen directly above it on both sides of the railway, so that this *specus* was still running: and it may, indeed, well be a last attempt to keep the supply going.

¹ *Sched. Vat.* 37. f. 117 (15. i. 1882).

² Lanciani, *Not. Scavi*, 1890, 11.

³ Levels were taken here, near the well-preserved stretch of the Aqua Marcia (III. 2), and the bottom of the Claudia was found to be at 66.23 m. and that of the Anio Novus at 69.09 m. (II. 4; I. 2): while 325 m. farther on they were at 65.76 and 68.63 m. respectively (II. 3; I. 1: *Livellazione*, fig. 6). The fall of the Claudia remained practically constant at 1.45‰. Five hundred metres farther on again a level was taken on the impost of an arch, in the Via delle Mura Latine, which was found to be at 59.38 m. (II. 1; *Livellazione*, fig. 5): but neither of these last two points affords a certain basis for calculation, as the bottom of the *specus* was not levelled.

narrow, arched opening, finally filled up altogether.¹ After the eleventh arch comes the next buttress (Fig. 25). All these well-preserved stone arches have been supported by two tiers of Hadrianic arches,² in brick-faced concrete; these have been underpinned at a late date on the west: while on the east, as the elevation shows, a very late wall has enveloped the whole structure, being stepped back at the spring of the arches, on a level with the offset at the impost of the stone arches and retaining a very narrow arched opening. The dimensions are as follows: 10.30 m. from the ground level up to the bottom of the impost mould, 0.45 m. thick, in sixteen courses, averaging 0.644 m. each: 3.95 from the mould to the string (0.45 thick) below the *specus*, in six courses, averaging 0.66 m.: 2.05 for the three courses of the *specus*, which is 1.14 wide and 1.75 high internally, allowing for the cement at the bottom: finally 0.50 m. for the oversailing slab crowning the *specus*. The width of the *specus* of the Anio Novus, on top of the Claudia was the same; but its height could not be ascertained.³

Three similar arches follow before a break, in which two piers are preserved to about half their height. Then come fourteen well-preserved arches, noteworthy for their travertine keystones. After two more arches another stone buttress occurs, only nine arches away from the last. Five more arches take us to a modern house: the three before it show rough *opus mixtum* facing the late reinforcement under the double Hadrianic arches, the top of the lower arch being cut away, as before, to get a key; the north-east side is entirely enclosed in a late wall.⁴ At the house there are two more arches, and another five precede a break of two, followed by one, well preserved. Then comes a break of two more, and a turn buttressed on the north-east. Three piers follow, the second and third showing Hadrianic reinforcement and very late restoration.

Now come fifty-seven arches of the Acqua Felice, interrupted by one ancient arch, and later on by five, in which the reinforcing arches of Hadrian are traceable. They are followed by sixteen arches, in which the original ashlar, the reinforcements of Hadrian, and very late work may all be seen.⁵ Then occurs a break of two or three arches; an ashlar pier, with a buttress, and eight more arches, one of which shows the original masonry. After this, on the north-east side of the aqueduct, close to a group of pig-sties,

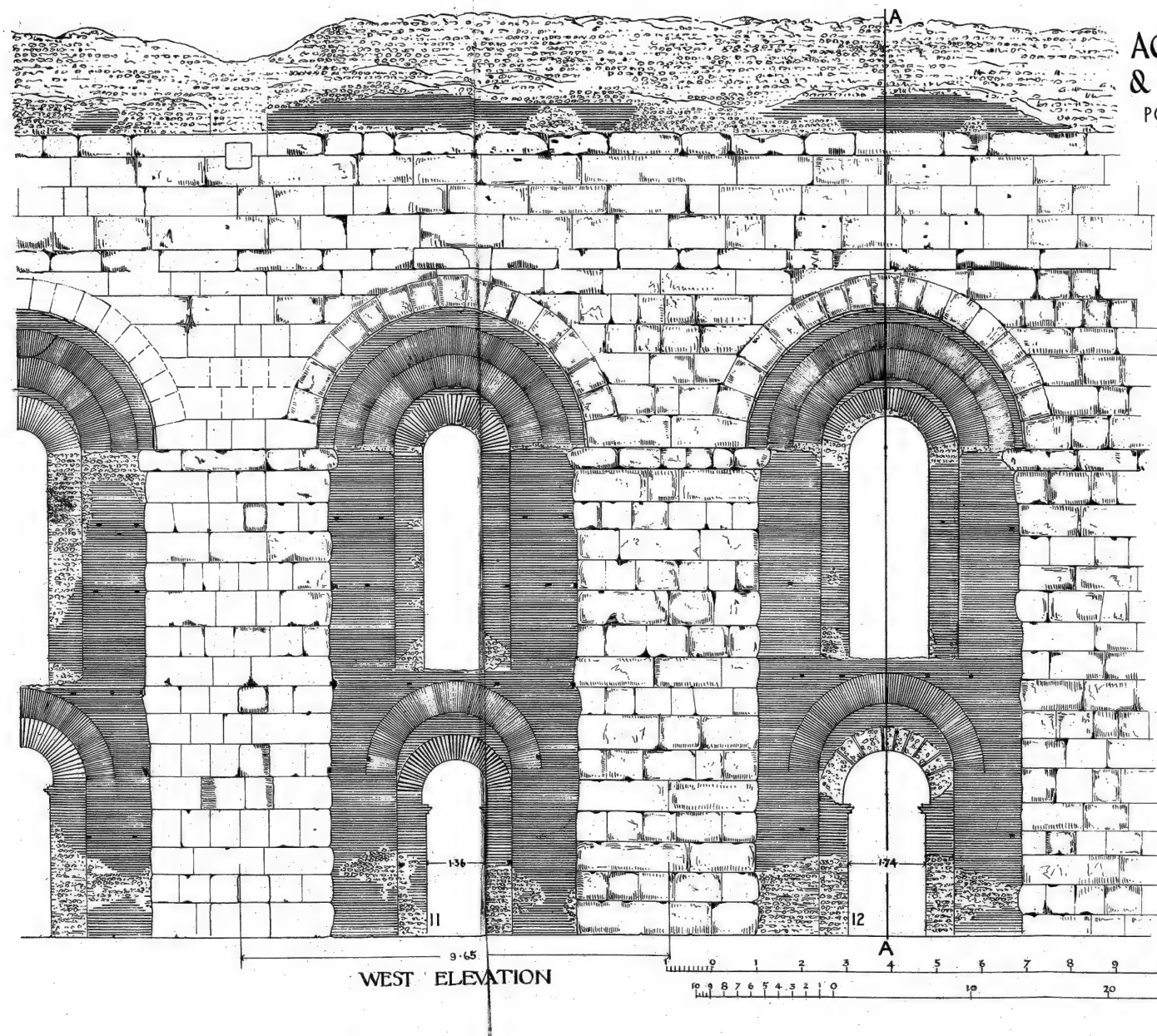
¹ For the *opus mixtum* here compare Aqua Marcia near the Osteria della Spiaggia wrongly attributed to the Claudia in *Livellazione*, see p. 99.

² They have a single ring of tile voussoirs below and a double ring above.

³ A square aperture may be seen in the *specus* of the Claudia and not far off I noticed a circular one on the south side, 1.15 m. from the top and 0.10 m. in diameter.

⁴ Here I found (loose) an example of *CIL*. xv. 419 (period of Commodus) which is, however, useless as chronological evidence.

⁵ At one point the late concrete shows three huge arches which are only skin deep and take no account of the earlier arches.



AQUAE CLAUDIA & ANIO NOVUS PODERE SACCARDO

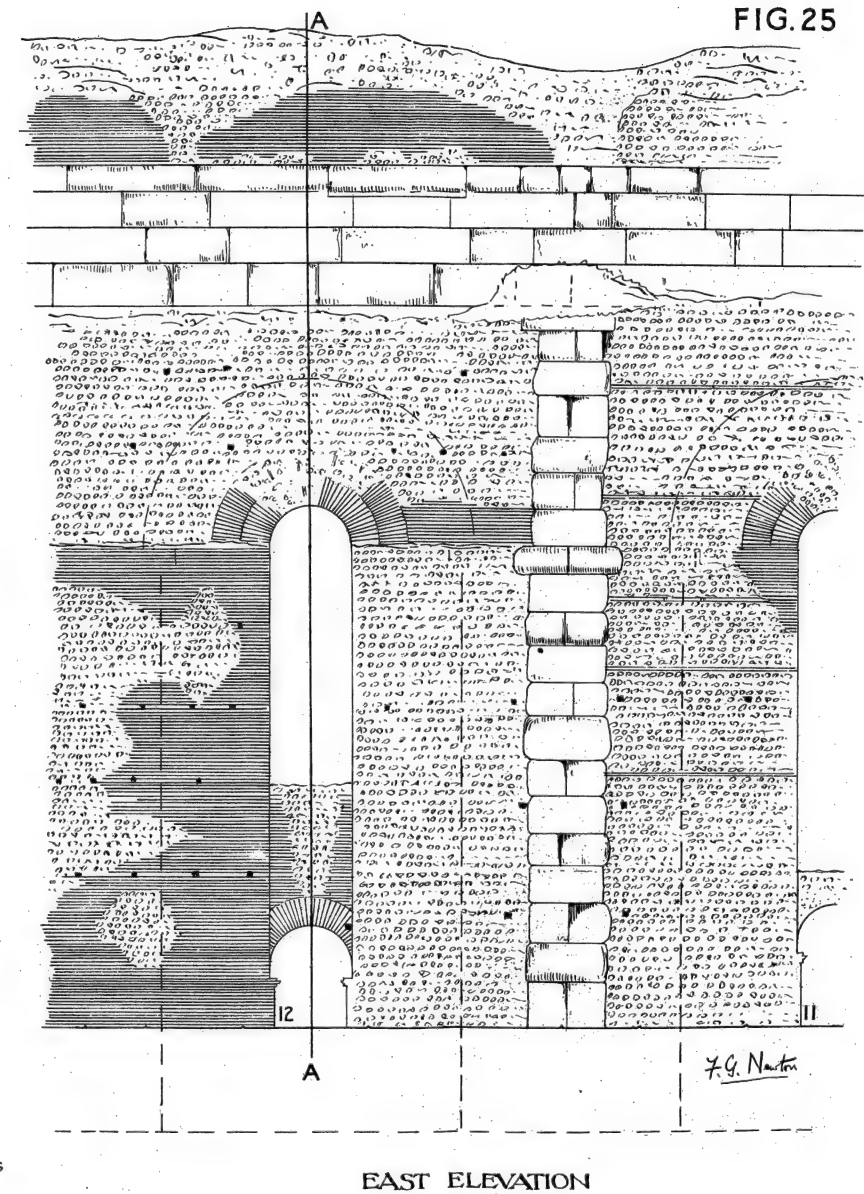
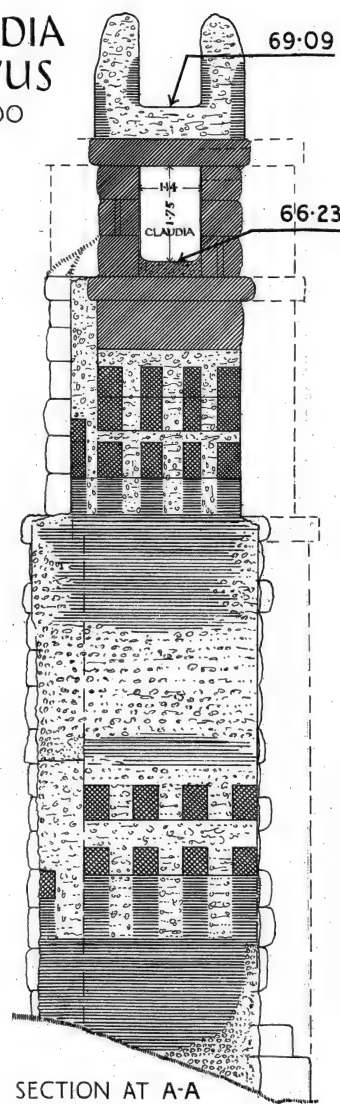
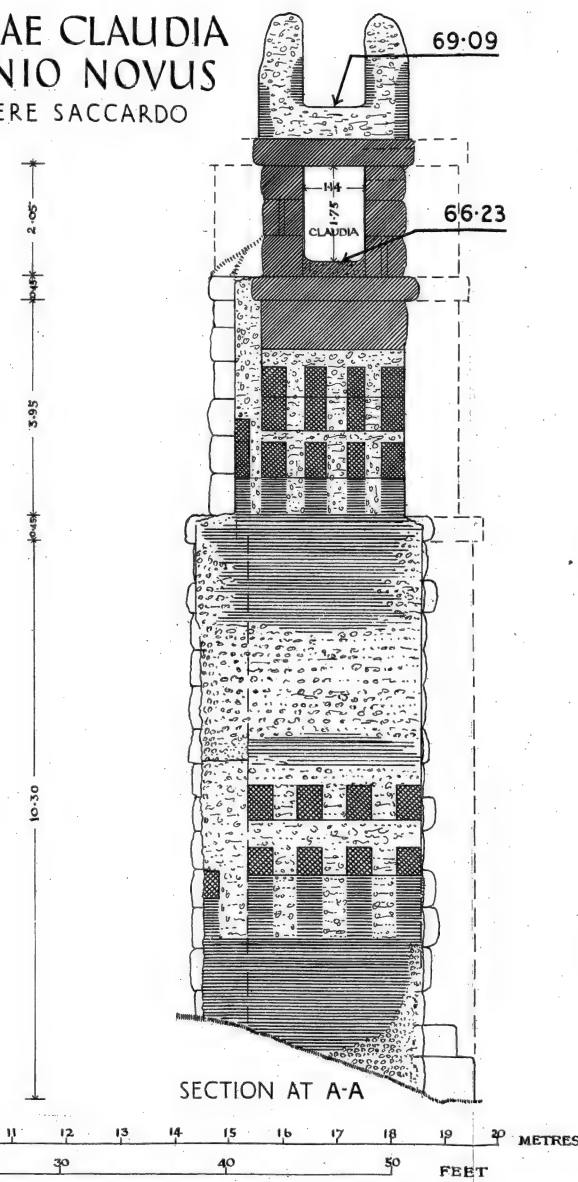


FIG. 25

there is another ashlar buttress, near the pier of Aqua Marcia, already described.¹ The buttress marks the outside of a turn, inside of which is a large pier. After it, three more ashlar piers may be seen on the south-west side, a fifth having been removed for the passage of Via della Marrana,² which passes the Molino S. Pio; the filling of the first two arches of the four is very late, while between the second pair it is Hadrianic. On the north-east side, there has been much late rebuilding, the *specus* of the aqueduct being restored in concrete, and an external staircase provided on the reinforcing wall, to facilitate repairs. Under these stairs are traces of earlier structures, not necessarily connected with the aqueduct. After this point the Acqua Felice has destroyed the greater part of the ancient remains, though the reinforcements by Hadrian are seen at intervals.³

The Acqua Felice was cut through, in making the branch line from the Naples railway to the goods-station of Roma-Tuscolana; and was found to have been built on the massive stone piers of the Aqua Claudia, reinforced with Severan brick-faced concrete.⁴ The same fact was ascertained further on, in cutting the connecting line with the railway to Florence in 1890, when the foundations of a pier of the Aqua Claudia were found: they were in *selce* concrete, and measured 4 m. thick, 3 wide, and 2 high.⁵ When Robert Guiscard came from Apulia in 1084, to assist Gregory VII, he encamped 'foris muros Urbis prope Lateranense palatium, in loco qui dicitur *ad arcus*', or 'ante portam qui via Tusculana porrigitur, *iuxta aquaeductus*.'⁶ This must refer to this stretch of arches.

At a point now 1,750 m. from the Opera Don Bosco, the aqueduct began to be made use of by Aurelian as a support to the City Wall on the inner side, being completely concealed on the outside. Lanciani⁷ describes this sector, now enclosed in the Caserma dei Granatieri, as having originally consisted of 45 piers, 34 of which are standing. They measure 4.02 by 3.60 m. at the base and are 5.50 m. apart. The fourteenth and fifteenth, counting from the pier at the turn near Porta Maggiore, are supported by two large concrete buttresses with a projection of 3.50 m. and

¹ *Supra*, p. 140.

² It cannot therefore exactly show the ancient line at this point: cf. Lanciani, *Storia degli scavi*, iv. 91; *PBSR.* iv. 42, 44, 52.

³ Several of them contained brick-stamps of the *figlinae Sulpicianae*, as Dr. Van Deman informs me.

⁴ Here in the former Vigna Marolda Petilli, other discoveries were made including that of a well about 25 m. deep, which still contained 3 m. of water, close to the aqueduct (*PBSR.* i. 220; see iv. 42, 52).

⁵ Lanciani, *Not. Scavi*, 1889, 350; 1890, 35.

⁶ Guido da Verona and Goffredo Malaterra of Watterich, i. 462, 464.

⁷ *Lanciani*, 150 : 362.

a width of 3.25 m. Between the twenty-eighth and the twenty-ninth are the remains of a very fine and interesting *castellum*, which the Anio Novus finally covered with calcareous deposit, so thick and contorted as to look like the natural formation in the hills near Tivoli. Piranesi¹ states that he found the course of the pipes in this cistern. The whole of this part of the aqueduct is supported and reinforced by concrete walls 0.90 m. thick, which seem to the writer² Severan. Venuti³ writes as follows: 'In the . . . vineyard of S. Croce in Gerusalemme, the aqueducts may be seen . . . entirely built of large rusticated blocks with a fine cornice above the arches; the monks have demolished a large part of this ornamentation in the last few days.'

The aqueduct then turned at right angles and crossed Viae Labicana and Praenestina immediately after their divergence, while they were still running almost parallel to one another. The fine Arch (Pl. XVII) which carries it⁴ over these roads is built of travertine, and is 24 m. high and 32 m. wide, the two road arches being 14 m. high, 6.35 m. wide, and 6.20 deep. In the central pier is a small archway, 5.10 m. high and 1.80 m. wide. Above this, and at the same level in the north and south piers, are open arches, framed in engaged columns with composite caps and entablature, never fully carved. The attic is divided by string-courses into three panels, the lowest purely ornamental, while the upper pair fronted the two *specus*.⁵ Each panel bears an inscription, already quoted, the uppermost recording the original construction by Claudius, the others restorations by Vespasian and Titus. Aurelian incorporated the Arch in a great Gate, later wholly reconstructed by Honorius, which acquired the name Porta Praenestina,⁶ later Porta Maior, and so Porta Maggiore. But all these defensive works⁷ were removed in 1838, exposing the aqueduct-Arch fully to view, with the curious tomb of Eury-saces the baker in front of it.

From Porta Maggiore to the terminal *castellum*, in the former Vigna Belardi, Lanciani⁸ shows twenty-six piers, including the three against which the *castellum* itself was built. The third, fourth, and fifth of these came to light in 1912⁹ just inside Porta Maggiore; they each measured 4.10 by 3.65 m. and were 5.80 m.

¹ *Antichità*, i, tav. vii, n. 133. ² Dr. Van Deman agrees. ³ *Roma antica*, 282.

⁴ See Platner and Ashby, *Topographical Dictionary of Ancient Rome*, 412, 479, 563, 566, for its details and for its subsequent history.

⁵ For architectural drawings of it we may refer to Canina, iv. 226-7 and D'Espouy, *Fragments*, i, pl. 81. Cf. also Piranesi, *Antichità*, i. pl. xvii, fig. 2; *Vedute* 119 (Hind.).

⁶ Procopius, *B.G.* i. 18.

⁷ They are shown in numerous Renaissance views, which are without importance for our purpose: see Richmond, *City Wall of Imperial Rome*, p. 105, pls. xx-xxi, fig. 41, for later views.

⁸ *Forma Urbis*, 32, 31, 24.

⁹ *Bull. Com.*, 1912, 228 ff. (E in plan); *Not. Scavi*, 1915, 6 ff. (unlettered).

PLATE XVI



AQUAE CLAUDIA-ANIO NOVUS IN VICOLO DEL MANDRIONE

apart, in ashlar masonry of *peperino*. The measurements agree with those of the piers in the former Vigna S. Croce as given by Lanciani.¹

Between these piers and those of the Aqua Marcia² three other piers were found in tufa ashlar: they measured 3.30 by 2.70 m. and were about 6 m. apart. They were not well preserved, a number of the blocks being missing, while thick concrete walls, faced with *opus reticulatum*, had been built over the remains. The presence of this later work shows that this aqueduct was not in use as late as the time of Septimius Severus: that it is post-Augustan, on the other hand, is demonstrated by the fact that a *cippus* of the Aqua Marcia (p. 143) was walled up in the last pier to the west. Its purpose is quite uncertain. The suggestion that it was the Claudia (in its original form)³ may have something to commend it; but it is still doubtful why its remains were not cleared away, unless they lay below foundation level and the reticulate walling simply obliterated all trace of it.

Five more piers of the main aqueduct were found in 1912, at 1.75 m. below modern road-level. The first lay 33 m. from the angle of Via Principe di Piemonte, and the other four followed, almost parallel to the Viale, bending slightly to the west. They no doubt correspond with those described by Belardi;⁴ for only one of them—the fourth from Porta Maggiore—had any of its ashlar left, namely four stretcher blocks. Of the rest, nothing was left but the concrete foundations, 5.10 m. in length and 4.50 m. apart; but, subtracting 0.54 m. on each side, we arrive at the size of the masonry piers, which agrees with the 4.02 and 5.58 m. recorded by Lanciani on the piers in the former Vigna di S. Croce. The dimensions no doubt conform to a standard. Finally, further remains of piers were found at two different points, in 1888.⁵

The *castellum* has completely disappeared since 1880. Before then, Lanciani⁶ was able to write that 'the terminal *castellum*, at which the arches of the Claudia and Anio Novus ended, still exists in ruins near the three arches⁷ of the railway.' Piranesi, who saw it in a better state of preservation, before the hay barn which was built within it caught fire, describes and draws⁸ the

¹ Lanciani 150: 362.

² *Supra*, p. 143.

³ *Bull. Com.*, 1912, 235; the brackets are mine, for the suggestion that Anio Novus and the Aqua Claudia were running separately here cannot be accepted.

⁴ Lanciani, 150: 362, tav. iii. 1. Belardi's statement: it is quoted by him from Piranesi. Cf. also Hülsen-Jordan, cit. 363, n. 53.

⁵ *Bull. Com.*, 1888, 77, where *vetere* is an obvious mistake for *nuovo*.

⁶ Lanciani, 150: 362, and tav. ii, fig. 5; cf. *Forma Urbis*, 24, which does not agree.

⁷ These arches were pierced through Aurelian's Wall for the railway, but have now been removed. They were at the west end of the existing gap.

⁸ *Antichità*, i, pl. xvii, fig. 1.

(vertical) hollows which indicated the course of the pipes along the walls: and goes on to tell us how, in the space between the *castellum* and the Porta Maggiore, 'in breaking up the ground a quantity of blocks of tufa and *peperino* were found, which Ficoroni¹ considers to have been ruins of the ancient Porta Esquilina. But when I questioned Francesco Belardi as to the discovery of these blocks, he asserted, pointing out to me the place from which they had been taken, that the remains consisted of six large piers, placed in continuous order . . . and added that other piers still remain to be uncovered near the *castellum*² . . . on the south-west wall of the *castellum*³ the impressions of the blocks of the last piers are still visible.' A very inferior small copy of Piranesi's view will be found in Giovanni Brun's album of views of Rome, where it is called 'castello di Costantino'. It consisted of three lofty chambers, side by side, with a much lower chamber to the north-west; in the internal face of each larger chamber are two double relieving-arches of large tiles.

(i) *Arcus Caelimontani*

As Frontinus⁴ notes several times, Nero constructed a branch-aqueduct from Aqua Claudia at Spes Vetus to the Temple of Claudius, which, as Suetonius⁵ observes, he almost entirely destroyed, no doubt in order to place there the distributing-station of which Frontinus speaks. The branch began where the aqueduct turned at right-angles from north to east immediately before reaching the Porta Maggiore. Of the original construction, in brick-faced concrete, much less is preserved than is generally supposed. Thus, the portions illustrated by Rivoira⁶ as the earliest examples of tile ribs are not attributable to the original construction; they resemble the Severan portion near the Arch of Dola-bella and Silanus.⁷

Fabretti⁸ illustrates one of the arches, contrasting it with the stone arches of the main conduit, in order to refute Nardini's absurd statement⁹ that the brick facing is additional and encloses original stone piers. He measured the *specus* as $2\frac{3}{4}$ feet wide, $5\frac{1}{2}$ feet up to the impost, the vault being $1\frac{1}{2}$ feet high and the side-walls $1\frac{7}{8}$ foot thick. The tile voussoirs vary, the inner ones

¹ *Labico*, 24.

² Piranesi, *Antichità*, i. 124; Nibby, *Roma antica*, i. 347. It cannot with certainty be identified with any of the ruins in Du Pérac's bird's-eye view.

³ Or rather, on the ends of the walls of the three main chambers, there being no separately built wall of the *castellum*.

⁴ *Frontinus*, 19.

⁵ *Vespas.* 9.

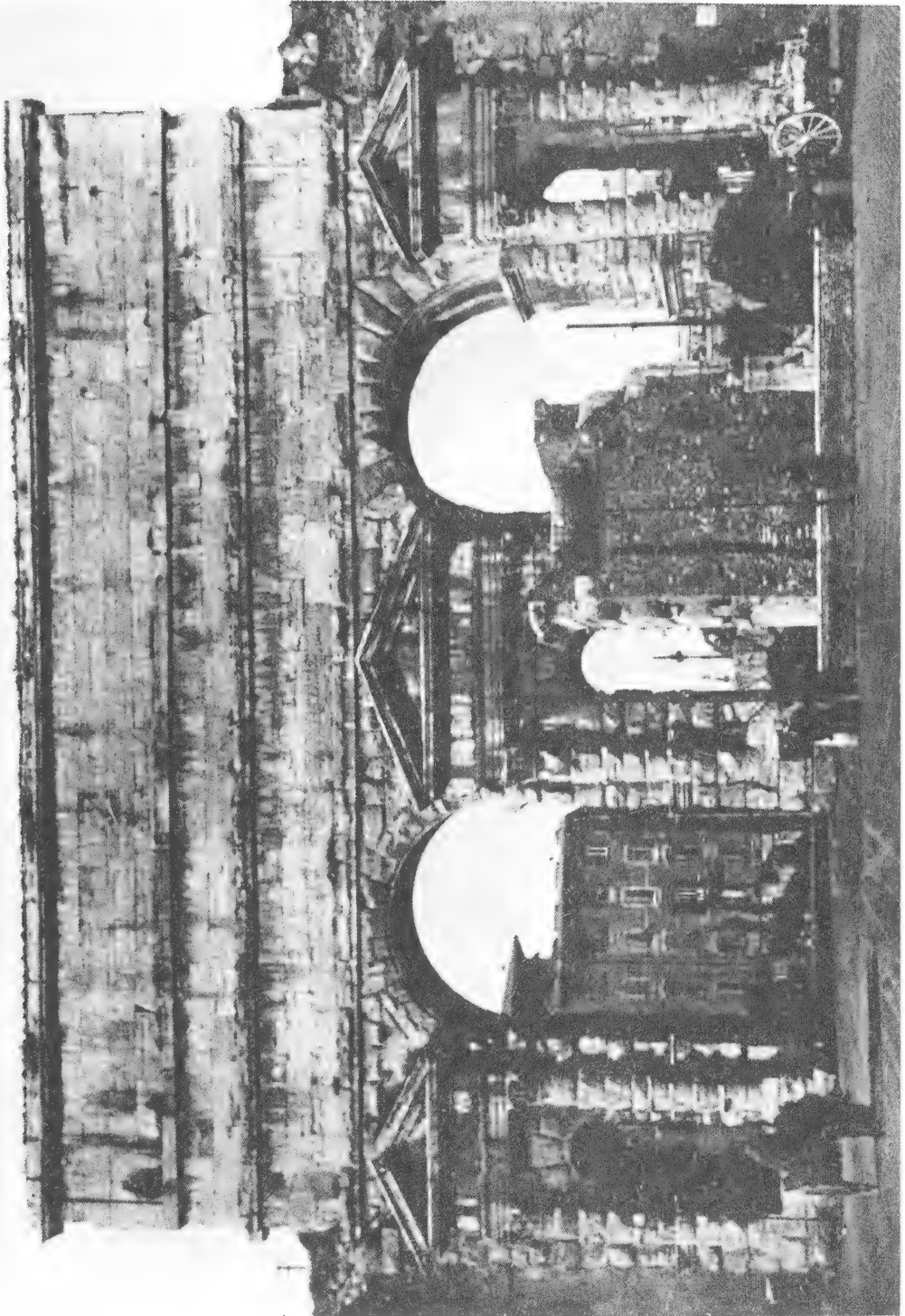
⁶ *Roman Architecture*, 72, 73; figs. 79 A, 79 B.

⁷ *Ibid.* 166, 167; fig. 199.

⁸ 23: 19, tab. viii.

⁹ viii, 4, p. 517. Fabretti thinks Nardini was misled by the Severan repairs.

PLATE XVII



AQUAE CLAUDIA-ANIO NOVUS A' PORTA MAGGIORE

being *bipedales*, the outer ones $1\frac{1}{8}$ foot wide.¹ The arches vary from $18\frac{1}{2}$ to $27\frac{1}{2}$ feet in span, according to their height.

Lanciani² describes the original piers as measuring 2.10 m. thick and 2.30 m. wide, with arches 7.75 m. in span and sometimes as much as 17 m. high. This lightness of construction is explained by Fabretti³ as being due to a desire to interfere as little as possible with existing buildings and roads. The *specus* is 0.716 m. wide, with walls 0.575 m. thick, and 1.633 m. high to the impost, the semicircular vault having a radius of 0.45 m. These measurements agree with those of Fabretti.

The greater part now visible, however, belongs to the restoration of Septimius Severus and Caracalla, recorded as follows:

*Imp(erator) Caes(ar) Divi M(arc) Antonini Pii Germ(anici) Sarm(at)ici filius, | Divi Commodi frater, Divi Antonini Pii nep(os), Divi Hadriani pronep(os) | Divi Traiani Parthic(i) abnep(os), Divi Nervae adnep(os), | L(ucius) Septimius Severus Pius Pertinax Aug(ustus) Arabic(us) Adiab(enicus) | Parthic(us) Max(imus) Pont(ifex) Max(imus), trib(uniciae) pot(estatis) viiii, imperator xi, co(n)s(ul) ii, p(ater) p(at)riae, proco(n)s(ul), et | Imp(erator) Caes(ar) L(ucii) Septimii Severi Pii Pertinacis Aug(usti) Arabic(i) Adiab(enici) | Parthic(i) Max(im) fil(ius), Divi M(arc) Antonini Pii Germ(anici) Sarm(at)ici nep(os), Divi Antonini Pii pronep(os), | Divi Hadriani abnep(os), Divi Traiani Parthic(i) et Divi Nervae adnep(os), | M. Aurelius Antoninus Pius Felix Aug(ustus) | trib(uniciae) pot(estatis) iiii, proco(n)s(ul), arcus Caelemontanos plurifariam vetustate conlapsos | et corruptos a solo sua pecunia restituerunt.*⁴

The relevant portion states that Septimius Severus and Caracalla in A.D. 201 restored at their own expense from the ground up the Arcus Caelemontani, in many places fallen and broken owing to their age. In this restoration, the width of the piers was increased from 2.30 to 4.60, the span of the arches being correspondingly diminished from 7.75 to 5.45 m. The new strengthening piers carried inner arches with two or three rings of tile voussoirs.

The inscription was intended to be set up in pairs on important arches by which the aqueduct crossed a road. Lanciani maintains that there were at least six major arches: two at the beginning of the branch, over the roads to the Sessorian Palace (S. Croce in Gerusalemme); the Arcus Basilidis, over the road from the Lateran to the Colosseum (Via Maggiore); a fourth crossing the Via di S. Stefano Rotondo; a fifth, according to Flaminio Vacca⁵

¹ Cf. *Inscr.*, p. 511. 'ut plurimum bipedales, non raro minores, existunt, ut notavi' (loc. cit.).

² *Lanciani*, 153: 365.

³ 23: 19.

⁴ *CIL*. vi. 1259.

⁵ *Mem.* 119 (Fea); 120 (Schreiber) in which he speaks of the discovery of numerous blocks of travertine (not, however, *in situ*) close to the church, which he attributes to this arch.

of travertine, near S. Maria della Navicella, over a road through the Servian wall; the sixth is the Arch of Dolabella and Silanus. He asserts, against Henzen, that there were not less than three sets of the inscription. The existence of two pairs is proved.¹ The first pair were affixed to the Arch over the road leading to S. Croce; the panel for the slabs of marble and the holes by which they were attached can still be seen in the brick-facing, on each side of the Arch. The slabs measured 5.40 m. wide, 1.80 m. high, and about 0.20 m. thick. The second pair, according to Henzen² the only set, graced the *Arcus Johannis Basilii* or *Basilidis*, the medieval name of an arch also called the *Arcus Formae*; well shown in Du Pérac's view (1577) but absent in Tempesta's (1593), though not thought to have been demolished before 1604.³

Lanciani maintains that one of a third pair was seen at the Navicella by Marliani,⁴ who, in his first edition, quotes the end of the inscription, and says 'iuxta hospitale Lateranense, inter alios, hic positus est index': while, in the second edition,⁵ he writes: 'legimus autem in marmore, apud portam Neviam reperto, M. Antoninum, L. Septimium, et M. Aurelium . . . arcus Coelimontanos . . . vetustate conlapsos a solo sua pecunia restituisse'. This was taken by Lanciani to refer to the inscription in question. But, for Marliani, the Porta Naevia is the Porta Maggiore;⁶ and he goes on to distinguish the site near the Navicella by saying 'haud procul ab aede D. Mariae in Dominica est arcus ex lapide tiburtino': but this is only the Arch of Dolabella, whose inscription he gives. Thus, his account of the Severan inscription cannot be taken to refer to the Navicella. What was visible there, on the other hand, was the inscription,⁷ in letters formed of large tiles, ANTON(IN)IANA, recorded by various authors⁸ of the

¹ De Rossi, *Le prime raccolte*, 29. Both Bembo (138) and Albertini (*Mirab.* 19) say that a copy in the collection of Giovanni Ciampolini had been found near S. Croce, while the latter says that he saw another copy 'non longe a lateranensi basilica . . . est lapis marmoreus in aquaeductibus'.

² *CIL. cit.*, 'mihi probabilius fuisse unum exemplum, cum inscriptio, quae in aquae ductu fuit ad D. Johannis, facillime dici potuerit esse repertum ad S. Crucis'.

³ So *Storia degli scavi*, iv. 1348, where Lanciani cites Du Pérac (1577) for a view of it: and Marangoni, *Mem. Anf. Flavio*, p. 56, n. 54 'al no. 20 nell'Armario I, mazzo III. n. 17 (dell'archivio dell'ospedale del Salvatore dei Sancta Sanctorum) ritrovasi una condonazione fatta di 28 giugno 1604 da' . . . guardiani della . . . Compagnia al popolo romano del prezzo di alcune pietre del Colosseo, condotte in Campidoglio per la fabbrica del nuovo palagio, in ricompensa che il po(polo) ro(mano) donato avea (regnante Sisto V) allo spedale della Compagnia in San Giovanni in Laterano un'arco antico, situato incontro all'abitazione del medesimo ospedale.'

⁴ *Topographia* (1534), 95 v.

⁵ *Id.* (1544), 77.

⁶ *Ibid.*, 15.

⁷ *CIL. vi.* 29843, cf. *add.*, p. 3732.

⁸ Fulvius, *Antiquitates* (1527), 32 v.; Ligorio, *Neap.*, lib. L.; *Bodl.*, f. 59 v. (cf. *JRS.* 1919, 186, where Antoniniana is given); Audebert, *MS. Lansdowne* 720, f. 280v; Vacca, *Mem.* 120 (Schr.); Giovannoli, ii. 19, 'Moniana', Cassio, ii. 110; Piranesi, *Ant.* i, tav. xli, fig. 2. Fulvius says: 'ut cubitales lateritiaque litterae ostendunt a fronte hospitalis S. Thomae.'

fifteenth to seventeenth centuries. Lanciani¹ considers that it had nothing to do with the aqueduct, a judgement no doubt biased by his belief that a copy of the inscription of A.D. 201 lay over the Arch of Dolabella. From the testimony of Fulvio, Giovannoli, and Piranesi, however, it is evident that the tile inscription stood on a building to the left of that Arch: indeed, the two latter agree in indicating the point as the next aqueduct-arch but one to it, and Giovannoli's view shows it clearly affixed to a reinforcement below the aqueduct-arch. But whether the inscription was originally set up here is as uncertain as to what it refers.

The best view² of the aqueduct is the bird's-eye view of Rome by Du Pérac (1577), in which its remains are very clearly shown. It is surprising to see how much appears to have been preserved. Nowadays, even since Lanciani wrote, the aqueduct has been further concealed by modern constructions; it may, therefore, be well to repeat and amplify his list of piers and arches,³ which can be followed on his *Forma Urbis*.⁴ Four arches span Via Eleniana, the road to S. Croce in Gerusalemme; these are entirely Severan. Nineteen piers exist in what was formerly the Vigna Conti, along the present Via Statilia; in some the original construction may be seen, but most of the work is of a very late period. Thirty-three piers occur in the Villa Wolkonsky,⁵ in which a good deal of Neronian work may be seen. Then come

¹ 161: 373.

² Piranesi, *Antichità*, I. xxiv. 2, near S. Maria in Dominica; Van Nieuwlandt's drawing (Chatsworth, vol. 6, fol. 8), apparently never engraved, may also be cited.

³ 152: 364.

⁴ Sheets 32, 31, 36, 35.

⁵ These piers are also seen in the background of Du Pérac, *Vestigi*, 26. For repairs hereabouts in 1826-33, see *Atti del Camerlengato*, tit. iv, fasc. 941, which contains (1) An estimate of Valadier for the restoration of the Aqua Claudia in Vigna Massimi (a result of the visit of the commission on 8 August 1826; a note of the visit of the commission also exists (ibid. 489) stating that the vineyard belonged to Francesco Massimo, and that the length of the portion in question was 1,490 palms: that four or five piers required repair, at a cost of 150 scudi, which was authorized) bearing date 6 June 1827, for 287 scudi, 65 baiocchi: five buttresses being required, owing to the removal of tiles, for an aggregate length of 76 palms and a height of 18. (2) A note of a letter from Valadier to Lovatti, dated 28 September 1828, asking him what repairs he had executed to the aqueduct above the roof of the *osteria* near the hospital of the Lateran, so that he might answer some questions of the Cardinal Chamberlain (the cost was 17 scudi, 40 baiocchi, as we learn from ibid., fasc. 852). A note of a similar letter asking him to remove the debris caused by opening Porta Latina. (3) A reply of Valadier to the Cardinal Chamberlain dated 24 November, that the repairs were urgent and were now finished. (4) Estimate by Valadier dated 6 July 1831, for repairs to the aqueduct in the vineyard formerly Massimi, behind the Scala Santa, for 294 scudi. (5) A letter from the Treasurer-General, dated 19 April 1833, asking whether the cost of restoration of the aqueduct close to the vineyard of Princess Wolkonsky (who had petitioned in 1831—see ibid., fasc. 1534—that three arches of the aqueduct, in the kitchen garden which had belonged to the Massimi, and was now her property, should be repaired) was to be charged to the estimates for antiquities or for the water-supply, the Treasurer being doubtful whether the restoration was that of a ruin or of an aqueduct still in use! A restoration of arches in Via S. Stefano Rotondo was done in 1900, and four views of the completed work are given in *Uff. tecnico per la conservazione dei monumenti, relazione* 1899-1902, pp. 4-7.

nine piers in the garden of the Passionist Fathers at the Scala Santa; some arches were destroyed here in 1680, but those extant are the best examples of the original construction, with well-preserved brick impost-moulds, while the internal reinforcing arches may be attributed to Severus.

The aqueduct then crossed the road, where a considerable part was destroyed in 1589 by Domenico Fontana.¹ There were, in the seventeenth century, three, and there still are two piers at the Osteria del Cocchio on the north side of the Piazza.² Then follow thirty piers, first on the right and then on the left of the Via di S. Stefano Rotondo;³ most of them are late. The Arch of Dolabella and Silanus⁴ (see p. 155) was made to form an aqueduct-arch, and ten piers lie between it and the first remains of the temple of Claudius in the garden of SS. Giovanni e Paolo. These last arches are shown in the *Forma Urbis*.⁵

A fragmentary inscription found in 1873 at the corner of Via Capo d'Africa and Via dei Querceti, behind the west apse of the church of SS. Quattro Coronati, relates to a very late restoration of the supply, perhaps, to judge from the lettering, even of the sixth century:⁶ *Salvis d(ominis) n(ostris) . . . victoribus . . . inter cetera magna quae . . . urbi etiam cisterna . . . fistula etiam i . . . ut alia multa . . . ubi felicissim . . . aquarum si . . . mi populares in . . . rum principum . . . fistula o . . . icae do . . .*

The slab is complete on the left, but it is uncertain how much is lacking on the right. It evidently refers to the rebuilding of cisterns and of the pipes connected with them; and one particular pipe seems to be mentioned, perhaps that supplying the person who set up the inscription. It is uncertain with what aqueduct it is connected.

In the Piazza della Navicella, the aqueduct, as Vacca had already conjectured, must have divided, one branch going to the temple of Claudius, the other to the Aventine. Lanciani⁷ believes that the *castellum* for the division was the large subterranean reservoir near S. Tommaso in Formis; and, as the bottom of it is 8 m. too low (40 m. above sea, as against 48 m. for the bottom

¹ The accounts of Fontana, extracts from which are published in *Storia degli scavi*, iv. 134, contain a 'misura et stima de tutta la terra levata per tutta la strada nova fatta dal culiseo alla piazza di S. Gio. laterano et buttato il sperone delli condotti antichi che avanzavano nella strada appresso il campo sto. del hospitale di S. Gio., quale impediva la strada et la vista di essa.' The fragment of aqueduct in the cemetery next to the women's hospital was 24½ palms long, 13½ wide, and 95 high (5.46 by 3.00 by 20.00 m.). This pier, as Du Pérac's view shows, must have stood to the east of the Arcus Basilidis.

² Lanciani marks here 'Scavi XII. 1887', but I do not know to what he refers.

³ To the north-east of the church of S. Stefano, where the hospital of the English nursing sisters now is, Lanciani marks 'Scavi Coll(egio) Germ(anico) VIII. 1890'.

⁴ Here Lanciani indicates 'Scavi Truica XI 1682', in front of S. Tommaso in Formis.

⁵ See sheets 45, 77, 96 (Hülsen-Jordan, 233).

⁶ *CIL.* vi. 3867 = 32058.

⁷ *Lanciani*, 157 : 369; cf. Cassio ii. 76.

of the *specus* of the Claudia in the Vigna Cavalletti on the Aventine) he postulates a second story. But this point lacks proof: nor have we any trace of the Aventine branch, either on the Caelian or in the valley between it and the Aventine, in the neighbourhood of the Porta Capena.¹ Its remains are perhaps to be recognized on the latter hill near S. Prisca,² in the building where the Castello dei Cesari is now established and where Lanciani indicates four piers and three arches. In ancient times, however, it must have been more conspicuous, to justify the language of Cassiodorus.³

The other branch led originally to the Temple of Claudius, which was converted by Nero into a reservoir. Twenty-seven arches are described by Cassio,⁴ who wrongly believed some to be pre-Neronian. He also noted,⁵ close by the garden near the new refectory of SS. John and Paul, a downshaft which received its water from the Claudia, and mentions numerous adjacent shafts. Lanciani⁶ remarks that 'all this requires careful examination. When, in 1874, the devastation of the arena of the Colosseum and the destruction of its substructure was begun, there was found at the southern extremity of the major axis the mouth of a channel descending from the Caelian . . . and as the main branch disappears into the bowels of the Caelian, pointing towards the Navicella, and as its construction and the intervals between its shafts correspond to the particulars described and drawn by Cassio, it is absurd to suppose that it served only for the exit of water (from the arena of the Colosseum), which, it is clear, must have run in the opposite direction. I therefore believe that this channel was earlier than the amphitheatre, and was used for the Stagnum Neronis.'

(j) *The Palatine extension.*

The branch which led to the Temple of Claudius was subsequently prolonged to the Palatine. The arches still visible in

¹ To make it the remains which Parker found immediately outside the Porta Capena would still further accentuate the difficulty we have already raised (p. 156) for they would then have had to carry a conduit at least 30 m. high.

² Piranesi, *cit.* i. 9. n. 184; xxiii. ii. A, B, C; Lanciani, *Forma Urbis*, 35; Nibby, *Roma antica*, i. 349, who compares the brickwork to that of the Aqua Traiana; cf. also *Note per la pianta del Nolli*, 1386 ff., 'Nella vigna del Sig. Ermete Cavalletti attaccata a S. Prisca si vedono moltissimi vestigi di muri antichi . . . attaccata alla casa della vigna vi sono tre archi di un acquedotto antico, che pare andassero alla dirittura di S. Balbina, il quale si vedeva che conduceva l'acqua su questo monte per servizio de' bagni, e delle gran fabbriche ivi esistenti, delle quali se ne vedono infiniti vestigi'.

³ *Supra*, p. 193, n. 1.

⁴ ii. 73.

⁵ ii. 108. 'Dal lato settentrionale di questo Speco cadente poco distante dal Giardino contiguo al nuovo Refettorio della casa de SS. Gio. e Paolo si vede lo speco e la forma d'un canal riquadrato uscire a perpendicolo, che dal medesimo speco prendeva l'acqua . . . Li prossimi numerosi pozzi che . . . attorniano tutto il terreno sul quale adesso si vede l'indicato giardino.' The *specus* must be E on the plate facing his p. 123, and the shafts are F, G, H.

⁶ Lanciani, 158: 370.

the valley between it and the Caelian show evidence of construction in two periods. The earlier is of Domitian, as is both historically reasonable and matches the technique of his work on the Palatine. The work of the second period consists in the filling of both upper and lower arches and may be attributed, with those of the rest of this branch, to Severus.

There are two tiers of arches,¹ insufficiently high to reach the Palatine; and Lanciani, who does not mention the two periods of construction, postulated two additional tiers,² attributing the whole construction to Septimius Severus, and assuming that Domitian built an underground siphon, for which, he thinks, the large lead pipe may have served. But to this theory there are several objections: in the first place, the arches would not have carried two more tiers; in the second place, high up on the Palatine, near the so-called Stadium, an arch lies in the line of the aqueduct³ and would have served excellently for the upper end of a siphon carried on the arches as they now exist; and it may be observed that such a siphon is essential if the water was to have reached a level where it would have been of service to the Palace. One difficulty, however, presents itself. Although all the plans and representations known to the author, except Piranesi's view,⁴ and Lanciani's *Forma Urbis*,⁵ show the arches running straight across the valley, there is no doubt that the lower arch on the pier close to the road lies not straight but at right angles to the rest. A right-angled turn in the middle of a siphon is unthinkable, and this arch must have some other explanation, unrevealed by the extant remains. It is uncertain whether there was another arch coming in the same direction as the rest, though Du Pérac, in his bird's-eye view of Rome (1577), shows some arches⁶ on the east side of the Via di S. Gregorio, between it and the apse of SS. Giovanni e Paolo.

But an inscription of A.D. 365, whose exact provenience is lost, may suggest an escape from the dilemma.⁷ It runs as follows: *Castellum aquae Claudiaae regioni pr[imae] dispositio dedit et usui tradidit iussu rationis Augustae d(ominorum) n(ostorum)*

¹ Du Pérac, *Vestigi*, 13.

² *Ruins and Excavations*, 186, fig. 69.

³ Already assigned to it by Du Pérac, *Vestigi*, 10 (D) (cf. the view of 1577), 'un pezzo d'Aqueduto per il quale veniva l'Aqua Claudia per servizio di detto Palazzo e di tutto il monte'.

⁴ *Antichità*, I. xxxiv. ii.

⁵ *Forma Urbis*, sheet 35: he does not allude to the turn in *Monumenti Antichi*.

⁶ Destroyed in part by one Cornovaglia on 14 Nov. 1596, while an arch and two piers were destroyed in 1712 (*Forma Urbis*, sheet 35). In 1832 the present arches were restored by Valadier, Lanciani, *Sched. Vat.* 37, f. 123.

⁷ *Lanciani*, 157: 369, wishes to make out that the first Region was supplied from the Aventine; but it is much simpler to suppose that the water was taken there direct from the neighbourhood of S. Maria in Navicella, which gives a much shorter line. The place where the inscription (*CIL.* vi. 3866 = 31963) was found is unluckily not known.

Valentin[iani] et Valentis victorum . . . Gai Caeioni Rufi Volusiani v(iri) c(larissimi) ex pra[ef(ecti) praet(orio)] praef(ecti) urbi iudicis iter(um) sacrar(um) cogn[itionum] curante Eustochio v(iro) c(larissimo) consulare aquar(um). Thus, it shows that the first Augustan Region, not very far to the south, was supplied from the Aqua Claudia, and it is possible that a branch left at this point,¹ accounting for the right-angled turn in the piers as we see them, but not necessarily tapped at this point from the siphon.

¹ Du Pérac, *Vestigi* (1575) pl. 14, shows three arches and two attached piers.

IX. AQUA ANIO NOVUS

FRONTINUS states that Aquae Claudia and Anio Novus were begun by Gaius in A.D. 38 and finished by Claudius fourteen years later.¹ After dealing with the Claudia, he proceeds as follows:

'At the forty-second milestone of Via Sublacensis, in the Simbruine district, the Anio Novus is drawn from the river, which has rich cultivated fields adjoining it, and, therefore, rather loose banks, thus running muddy and turbid even when unstirred by rain. For this reason a settling-tank was put in at the catchment, where, between river and channel, the water might settle and clarify itself. But even so, whenever showers occur in addition, the water reaches the City turbid. The *rivus Herculanus* is its tributary, which rises at the thirty-eighth milestone, on the same road, near the springs of the Claudia, but on the opposite side of the river and road; and this is naturally a very pure source, but loses by the admixture the charm of its clearness. The conduit of the Anio Novus measures 58,700 paces in all, of which 49,300 are underground and 9,400 paces above ground: of the latter 2,300 are on substructures or arches at various points in the upper course, while nearer the City, from the seventh milestone onwards, 609 paces are on substructures and 6,491 paces on arches. These are very high arches, rising at certain points to 109 feet.'² Again, 'The Anio Novus was set down in the Records as having 3,263 *quinariae*. Gauging at the source, I found 4,738 *quinariae*, more than the scheduled supply by 1,475: and how can I demonstrate more plainly that I do not over-estimate the number of *quinariae* at source, than by the fact that in the delivery-records most of this water is actually accounted for. For 4,200 *quinariae* are delivered, though elsewhere in the same records the volume at source occurs as only 3,623. Further, not merely 538 *quinariae* (the difference between our gauging and the recorded delivery) but much more are intercepted. Hence, it is clear that the amount even exceeds my figures. The reason for this is that the rather swift current, drawn from a broad, fast stream, increases its volume by its own velocity.'³

Frontinus then describes the improvement of the source.

'But it was not enough for our Prince to have restored the volume and quality of the other aqueducts. He also saw that the defects of the Anio Novus could be stopped. Thus, the river⁴ was cut out, and he ordered the water to be taken from the lake above Nero's Sublacensian Villa, where the Anio is clearest. For the Anio rises above Treba Augusta, and, whether because it runs between rocky mountains, there being little cultivated land even round the village, or because it is purified by the depth of the lakes that receive it and shaded by the dense woods which surround them, it arrives there both very cold and very clear. This very fine quality of the water, equalling the good points of the Marcia and even exceeding it in quantity,

¹ *Frontinus*, 13, A.D. 52.

² *Id.*, 15. He refers to these arches again (20). 'The Anio Novus and Claudia are carried from their settling-tanks on lofty arches, the Anio being above.'

³ *Frontinus*, 73.

⁴ Compare *Plin. Ep.* viii. 17, for a description of an inundation of the Anio in the time of Trajan.

will now replace the ugly, turbid supply; and an inscription will declare its new founder, Emperor Caesar Nerva Traianus Augustus.¹

Other authors,² Pliny the Elder and Suetonius, refer to this aqueduct with the Claudia.

An inscription³ of A.D. 381 recording repairs was found reused on Tiber Island: the text, supplemented by Borghesi, is as follows: *immine[ntem ruinam . . . aquae] | Anienis N[ovae] [. . . avertit Val.] | Anthidiu[s v.c.a.u. praef. praet. et urbi] | insisten[te] | consula[ri aquarum] | Nov. Syagrio [et Eucherio cons.]*.

The Claudian inscription⁴ on Porta Maggiore gives the length of Aqua Claudia as 45 miles, and of the Anio Novus as 62 miles. Frontinus gives lengths respectively of 46.46 and 58.7 miles. The discrepancy of the latter contrast is explained by the editors of the inscription as due to a diminution in the length by Trajan; but, as Albertini points out,⁵ Trajan rather increased the length. Thus, he suggests that the inscription originally read LIX, agreeing with Frontinus, and that Trajan substituted new figures by inserting a new block of stone on each side of the attic.

Computing by the map, which is only approximate,⁶ the result⁷ is 72.675 km. for Aqua Claudia, and 84.448 for the Anio Novus; the figures of Frontinus being equal to 68.75 and 86.9 km. respectively. Thus it looks as if the windings had been overestimated in one case, and underestimated in the other

(a) *From the source to Vicovaro. Map 7.*

THE lakes at the source of the Anio Novus are mentioned by Pliny the Elder⁸ as really three in number. Tacitus⁹ notes the *Simbruina stagna [in villa] cui Sublaqueum nomen est* as the place where Nero was almost killed by lightning; and it was Nero who built the Via Sublacensis itself.¹⁰ The natural features of the ground have somewhat altered since classical times, and the lakes have disappeared; so that there has been considerable discussion as to their situation. The question has been dealt with by Giovannoni¹¹ fully and, in the author's view, correctly.

¹ Frontinus, 93.

² Statius, *Silv.* i. 5. 25, is ambiguous, but probably means this one as against Anio Vetus.

³ *CIL.* vi. 3865 = 31945: cf. Borghesi, *Op.* viii. 348. The inscription was seen in the pavement in front of the fountain in the court of the Hospital of the Fatebene Fratelli. Why Lanciani 143 : 355 assigns it to the upper course of the aqueduct I do not know. It seems equally unlikely that *CIL.* xiv. 3682, a Tivoli inscription, refers to the main aqueduct. Nor is Fabretti right in interpreting *CIL.* vi. 777 as applicable to an aqueduct at all.

⁴ *CIL.* vi. 1256: the phrase is *a milliario LXII*: this cannot refer to Via Sublacensis, which was only 46 miles long.

⁵ *Mélanges de l'école française*, 1906, p. 311 ff.

⁶ No map of a scale larger than 1 : 25000 is available: nor can the windings underground be accurately estimated, though these are less on this pair of aqueducts than on the others.

⁷ The total is taken from the figures in the sections of the *Livellazione*.

⁸ *N.H.* iii. 109, *lacus tris amoenitate nobilis, qui nomen dedere Sublaqueo*.

⁹ *Ann.* xiv. 22; the addition *in villa* is due to Bezzenberger, and is accepted by Fisher in the Oxford Text. Perhaps *in loco* is sufficient.

¹⁰ Frontinus, 7.

¹¹ *I monasteri di Subiaco*, i. 273 ff., whence the measurements are taken.

The construction of the road from Subiaco to Jenne in 1883-4 led to the discovery¹ of considerable remains of the dam at the lower end of the middle lake and of the bridge which stood upon it, just above the Ponte di S. Mauro, on the present high-road from Subiaco to Guarcino by the Piani d'Arcinazzo (Pls. XVIII *a, b*). The dam, still preserved on the right bank, was about 13.50 m. wide at the top and paved in tiles: it carried a bridge on piers. Its width, close to the bank, where some *opus reticulatum* and brick-walling have been added, was 10.95 m., with two piers 1.30 m. thick: further on, it narrowed to 7.40 m., the piers being 0.90 m. thick, except the last, which was 1.20 m. The span of the low arches which sprang from these piers was 3.50 m. The piers were built of massive blocks of travertine below and brick-faced concrete above; the arches were of concrete, with travertine voussoirs at their outer edge and rings of large tiles, two feet square, at intervals in the vault. A mass of concrete may still be seen, near a small modern house, pierced by low brick arches of a smaller span (about 1.60 m.) and choked with deposit.

No trace remains of the sluices. It was noted that the tile pavement on top of the dam sloped towards the centre, so that, when the water was low, the stream was constricted. Remains of a marble parapet were also found. Above the dam, on the right bank, some concrete walls belonging to the villa appear; they are faced with *opus reticulatum*, quoined in tufa and brick, and represent small rooms, perhaps belonging to baths, with a reservoir above. In the remains of a small marble-paved building, with walls faced in marble up to 2.50 m. in height and then painted, were found the statue of a youth and the head of a sleeping girl, now in the Museo delle Terme.² On the left bank the lofty walls, with a central apse backed by a corridor, belong to a *nymphaeum*.³

Above the dam lay⁴ two of the three lakes which Pliny men-

¹ *Not. Scavi*, 1883, 19; 1884, 425. Parker's photographs (1514 ff., some of which are reproduced in *Aqueducts*, pls. iii-v, see text p. 125) were taken before the discovery of this dam.

² Helbig, *Führer*, ii3. 1353, 1355.

³ A good seventeenth-century plan and elevation of these will be found in *Cod. Barb. Lat.* 4426 (formerly XLIX. 35), f. 37 v., 38 v.: the beginning of the *specus* is also noted. The period of construction on the right bank seems to be that of Trajan, while we must recognize the work of Nero on the left bank. The dam of the time of Nero no doubt provided the necessary crossing, though there is none of his work in the existing dam.

⁴ This is not altogether Holste's view (*Adnot. in Cluv.*, p. 128): 'lacus . . . illi tres haud naturales, sed artificiales fuere. Primus quidem sub Monasterio Sanctae Scholasticae, cuius os angustissimum, xviii circiter, vel xx pedum muro validissimo clausum fuit. Inde Aqua defluebat in secundum lacum, qui mox primum excipiebat, cuius os paullo fuisse latius videtur. Tertius deinde sub ipso Oppidulo Sublacensi fuit, ubi etiam magna Anienis pars muro constringitur, ad varia molarum officia: huic imminet Ecclesia Sancti Laurentii, a Nursio Patritio sub Damaso Papa extructa, quae ad Aquas Altas dicebatur, ut antiqua donationum instrumenta Sublacensis Monasterii testantur'. Thus, he places only one lake

tions. They were not far apart and probably at the same level. Medieval documents speak of one lake or two. The third, below them, must have disappeared at an early date, so that, as Giovannoni says, medieval folk only saw one lake, divided into two pools, about 459 m. above sea level: this is depicted in the church of the Sacro Speco, on the fresco of the saving of S. Placidus, painted by *Magister Conxolus*, probably between 1217 and 1227.¹ A picture of S. Benedict fishing, in the sacristy of the same church, shows the dam in ashlar, looking up-stream, with two arches through which the water flows, and the *nymphaeum* of the Villa of Nero on the right. The bridge is constantly referred to as *pons marmoreus* in documents of this epoch: and the lake existed until 1305, when a flood,² coming after two over-zealous monks had removed stones from the dam, swept much of the structure away.

Giovannoni considers that the aqueduct began at the lower end of the middle lake, and followed a *specus*³ which Gori had already noticed, but which Lanciani⁴ and Canina⁵ refused to accept as the Anio Novus, on the ground that it was too narrow.⁶

above the dam, the second immediately below it, and the third below the town of Subiaco, immediately under the church of S. Lorenzo (cf. p. 256, note 7).

¹ Giovannoni makes the upper lake 800 m. long, the intervening space about 150 m. long and 50 m. wide, and the middle lake 700 m. by 110 m. The third lake, according to Giovannoni, was situated at a lower level, whether immediately below the second or at some distance is doubtful. In favour of the former supposition he cites remains of walls, just below the gorge crossed by Ponte S. Mauro or Ponte Rapone, which may have belonged to its dam (Parker, *Hist. Photogr.* 1515, 1518): while there are arguments of local nomenclature in favour of the latter.

² 'lacus monasterii ad nihilum redactus, quia duo monachi levaverunt duo lapides, qui fuerunt firmati cum aliis petris; et sic aqua destruxit.' *Chron. Sublacense*, Muratori, *Rer. Ital. Script.* xxiv. 962 D. A longer version is in *Chronicon Sublacense* by Mirzio: 'per duos caeteris monachis animosiores de supremo laci muro aliquos lapides grandes extrahere fecerunt, quo alluvies aquarum nimia citius afflueret. Porro inundationis impetus tam vehemens fuit, ut murus eum minime sustinere potuerit, sed in alteram partem inclinatus ad terram ruerit.'

³ Gori, *op. cit.* 20. Cf. Parker, *Historical Photographs*, 1516, 1555; also a constitution of Clement III, dated 1189, in favour of the abbey of Subiaco (*Bull. Cass.* ii. 218, Const. ccxii); 'de forma quoque antiqua, quae ducit aquam de flumine ad plebem S. Laurentii, de aqua, quae vocatur Augusta, nemini liceat, praeter voluntatem vestram, aquam derivare, nisi quantam sufficiat terris rigandis, et replendo fonte Baptismatis in eadem ecclesia.' The aqueduct was erroneously, though naturally, called Aqua Augusta. According to Fabretti, these phrases were repeated in a constitution of Honorius III (1217); and a bull of John VI (704) makes use of similar language. 'Casale quod vocatur Augusta, cum integro suo monte, ad Castellum faciendum. Item integram Aquam Augustae, et antiquum Aquaeductum, vulgo Formam, per quam Aqua a Lacu ducitur, et in Fluvium fluit ad S. Laurentii Ecclesiam, qua dicitur Plebis, itaquod nullus omnino hominum facultatem habeat ex eo Aquam educere, nisi pro Fontis Baptismatis, seu horti irrigationem vel utilitatem.' The editors of the second edition, unable to find either document in any collection of bulls (71. n.b. 72. n.a.) to which they had access, supposed that they belonged to the *Regestum Sublacense*.

⁴ Lanciani, 140: 352.

⁵ v. 136.

⁶ A discovery made in 1910 is described by Mancini (*Not. Scavi*, 1910, 239) as follows: 'The stone quarry belonging to widow Ciappi, in the place called Sorricella, not far from the electric works near Subiaco, is interrupted by the remains of a Roman aqueduct, which

But, as Giovannoni points out, it is big enough for the 4,000 *quinariae* of Anio Novus. This *specus*, then, begins to be visible about 100 m. from the dam,¹ and runs along the edge of the cliff, following its windings for about 35 m. It is rectangular, measuring about 1.70 m. high and only 0.40 m. wide at present,² being much obstructed by incrustations. Then it tunnels below the hill for about 35 m., shaped almost triangular, its floor being 0.70 m. wide and its height 1.90 m.³ After this, it follows the windings of the cliff once more, on the edge of the high road from Subiaco to Olevano, where it may be followed for 55 m.; the top is now rounded and the channel measures 0.40 m. wide and 1.70 m. high. As the road rises, it disappears; but Gori noted its continuation in the olive yard of Enrico Gori, in the district called Soripa,⁴ first cut in the rock, and then built in concrete;⁵ a piece of the *specus*, which he once believed to be a part of the clearing-tank of the aqueduct,⁶ had fallen from the hill of S. Lorenzo into the river-bed: it was 1.83 m. wide and 1.55 m. high.⁷ In this sector, allowing for the windings⁸ of the *specus*, the gradient is certainly less than 15 in 1000, thus disposing of Lanciani's objection, that the descent is too rapid for a main aqueduct. From the last point where it is seen,⁹ the aqueduct probably tunnelled through the rock, which is very soft and friable, instead of following the windings of the valley. This is perhaps why it is not visible opposite Subiaco.

has up till now been uncovered for a length of about 15 m., running from north-west to south-east, and curving slightly to the south-east. It is built upon a thick stratum of river sand: it is built of concrete with much mortar, and the external facing is of small rectangular blocks of a local stone called *cardellino*. The *specus* is 2.50 m. high, and 2 m. wide, and is lined with cement and mortar. The aqueduct is remarkable for one point: where the curve begins, the walling is strengthened by projecting reinforcements to diminish the impetus of the water. It is the only relic of any aqueduct worthy of note which remains in the whole territory of Subiaco.' The writer could not verify the description in 1912, as the *specus* seemed to have been covered up again. It is improbable that this aqueduct came from the Anio Novus, which seems always to have followed the left bank of the river: but, if Giovannoni is right in placing the main portion of Nero's villa hereabouts, this channel may have been its supply.

¹ Giovannoni, p. 276, fig. 1 d.

² These are Gori's measurements: to me this portion seemed almost triangular: the curved top was 0.20 m. wide, but the width increased rapidly to 0.55 m. in 0.60 m. (vertical).

³ It is 492.53 m. above sea level (Gori, *Vere sorgenti dell'Acqua Marcia*, 32).

⁴ Op. cit., 14.

⁵ I saw it myself, here, going NNW. in 1909, and again in 1925, 50 m. from the lower gate of the Villa Gori.

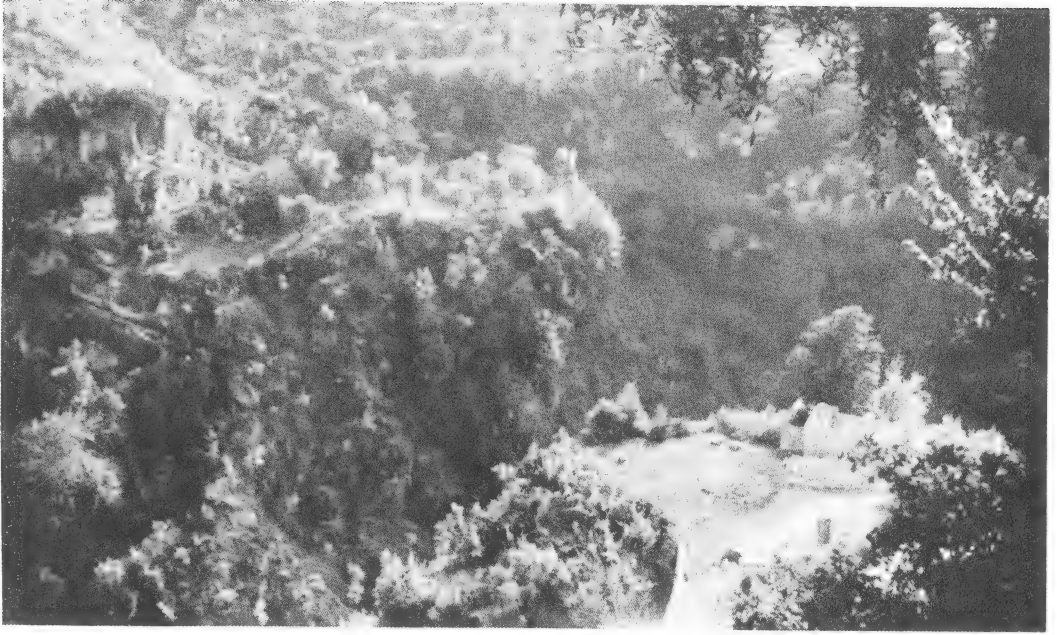
⁶ See *Viaggio*, 10; cf. *Vere sorgenti*, 47.

⁷ He goes on to say that the aqueduct can be seen on the right (*sic*) bank all the way down passing by Via della Pila, Campo d'Arco, Costa Pignataro, Bocca di Cona, &c. We have seen that Holste notes that the Church of S. Lorenzo di Norcia bore the name '*ad aquas altas*', which he associates with the lowest lake; Revillas (*Vat. Lat.* 9024. 103) calls the church also S. Lorenzo de Plebe; it still exists, opposite Subiaco (Giovannoni, p. 274, n. 3).

⁸ This gives the length of the *specus* down to the confluence of the Fosso Mora as nearly double the 3,750 m. which we have conjecturally assigned to it.

⁹ I saw a possible trace of it—one side only and part of the roof of a very roughly cut channel going 40° N. of W., just north-west of a path leading to the Madonna del-

PLATE XVIII



a. ANIO NOVUS: SITE OF DAM AT SUBIACO



b. ANIO NOVUS: REMAINS OF DAM AT SUBIACO

Revillas notes Via della Pila as one of the places where the aqueduct was visible. He then mentions remains of the aqueduct at 20 feet¹ above the Anio, on the left bank, opposite the confluence of Fosso Mora: this is about a mile down-stream from Subiaco, below the Osteria di S. Antonio. Fabretti² also shows remains of arches, no longer to be seen. Hereabouts, at the place called Campo d'Arco, the writer was told that the aqueduct had been found below ground; and at Pozzo S. Giovanni he was given similar information. The ground was cleared in May, 1909, and about 0.20 m. down the very bottom of a rough wall (only about 0.12 to 0.15 m. in height and 0.59 m. thick) was brought to light: it was running 25° E. of N., about 0.60 m. from the rock at the edge of the slope, and may have been the inner wall of the aqueduct. The place is east of Colle Alto, opposite the level-crossing of the railway.

Revillas noted that, though the aqueduct was generally subterranean as far as Marano, traces were to be seen above ground at a place called I Colli, along the field-path, close to the Ponte Minnone on our map. Here, in the property of Don Lorenzo Lella, the rough concrete roof of the *specus* may still be seen about 3 m. above the river, running under a bank: the width is said to be about 1 m. and the general direction about north-west. The place must be some 360–70 m. above sea-level. About 200 yards farther the path runs on top of the aqueduct.

After this I could find no trace of it for some way. Opposite the village of Agosta, just north of Fosso della Selva, there are some 20 yards of substructure in concrete, faced with roughly rectangular pieces of limestone, and running 15° W. of N. At the north end of it is an apse 6.80 m. in diameter; and it is uncertain whether this structure belongs to the aqueduct. There is nothing more to be seen until we get about a kilometre north of Marano, where, below the hill 402 m. high, and just below the railway and path, there is rough concrete, faced with limestone, running along the bank, and what looks like the pointed top of the *specus*.³ No doubt the aqueduct runs along this level all the way, and the path at the edge of the fields probably marks its course. But even Revillas could see, after Marano, nothing but some substructures in the bushes. Some sulphurous springs rise

l'Appello. Holste states 'Huius aquaeductus vestigia visuntur nunc sub ipso Sublaqueo, vocaturque vulgo il buso della Cartiera. Deinde sub Xenodochio D. Antonii, atque inde super iuxta sinistram fluminis ripam tendit. Altitudo eius hoc tempore XX pedes ipsum fluminis alveum superat; unde de lacus altitudine conicere licet'. Gori's identification of the spot (p. 31) is open to question.

¹ The ground level at the confluence is 381 m., so one may put it at about 385 m.

² 67: 59; *Diss.* ii, tav. 1, no. 25.

³ The ground level is about 324 m. The arches I thought I saw (*Builder*, 64) from the further bank turned out to be non-existent.

to the north-west: and, at Mola Nuova, there are other slightly acidulous springs, which, though unnoted by Lanciani, are undoubtedly those of the *rivus Herculeus*, which Frontinus states to have risen about thirty-eight miles from Rome opposite the springs of Aqua Claudia.¹ This source was extremely pure, before admixture with the river-water befouled it.

Opposite the small tunnel of the main railway-line, west of the tunnel under the ruins of Rovranello and south of Ponte Nuovo on the staff map, the *specus* was seen in February, 1901, on the south edge of the Subiaco railway. It was round-headed, cut in the rock and lined with cement, 1.20 m. wide and running 36° W. of N. There is no mention of it in literature; nor have I obtained its level, which must, however, be about 314 m., the crown of the vault being about 2.00 below the level of the line. The *specus* was also found recently, in making a new intake for a channel of the electric power works, between the fifty-second and the fifty-first kilometres of the modern road. It was round-headed, faced with *opus reticulatum*, with an impost 313.75 m. above sea-level.²

About half a kilometre farther down the valley, exactly opposite the fifty-first kilometre-stone of the modern road and in a line with a stone field-wall which runs straight towards the summit of Monte Aguzzo, are the scanty remains of the Ponte Arconi. It is mapped with several arches by Fabretti, who believed it to be a bridge which carried the Anio Novus across the river,³ an error

¹ *Frontinus*, 15. 'iungitur ei rivus Herculeus oriens eadem via (sc. Sublacensi) ad miliarium tricesimum octavum, e regione fontium Claudia trans flumen viamque. Natura est purissimus, sed mixtus gratiam splendoris sui amittet.' Lanciani and others state that remains of the aqueduct are to be seen here: but I have never been able to detect anything but the ruins of a villa. There is an embankment wall 60 paces long just above the springs, running 40° W. of N., with weep-holes in it. A little to the south-east of the centre is a curved niche 3 paces wide, and on each side of it a rectangular (1.50 m. wide) and a curved niche. The wall is of concrete faced with *opus reticulatum* and brick, with some *opus incertum*. Behind it, near the north-west end, is a small passage, 0.43 m. wide, in concrete, which goes on in a north-westerly direction, but is not traceable to the south-east, so that it cannot be the channel of the aqueduct. Another wall runs at right angles to the first for 34 paces from its north-west end. There are no buildings on the platform above the longer wall. Gori (*Acqua Marcia*, 72) wrongly supposed that the Anio Novus crossed the river at this point: 'valicato il fiume sul ponte di Anticoli Corrado, dopo le mole, si può riscontrare in un terreno dei conti Vetoli, in contrada Casa degli Arci, il sito preciso dove accadeva il passaggio di questo speco all'altra riva': but Lanciani was not able to find any traces of the crossing.

² I owe this information to the kindness of Ingegnere Francesco Fontana.

³ Cf. 67: 59, *Diss.* ii, tab. i, 10, where he calls it, 'alius (aqueductus) Anienem a dextra in laevam sub Rubiano transmittens et in montem recta se immergens'; it was known in the Middle Ages as *Arcus de Ferrata*. Cf. *ibid.* 80: 71; 'Quandoquidem Apostolica haec, vel similia probae notae indulta . . . quicquid ab ipso Monasterio ad Arcum usque Ruviani iacet, comprehendunt. [The reference is to the Constitution of Clement III, already cited: Lacum, sive Fluvium ex eo procedentem, in quibus Aquis nemini, praeter Abbatis et Fratrum voluntatem, aut piscari aut Molendinum aedificare liceat, usque ad Arcum, qui dicitur de Ferrata in territorio Ruviano]. Quem credo, esse eundem Aqueductum, qui Anienem sub Ruviano transmittere conspicitur, Tab. i num. 10; et ita, in tanta

the more surprising because in this very map remains of the Anio Novus are shown on the same bank at Buso della Cartiera. Revillas,¹ on the other hand, believed that it carried the Marcia across the river, and describes it as about 3 miles from *cippus* 1242 of Aqua Marcia. He notes that it consisted of low arches, about 8 feet in span,² in *opus reticulatum*, the *specus*, $5\frac{1}{8}$ feet wide, being hardly 5 feet³ above the river. The deposit was crystalline, like that of the Marcia, and there was a *puteus* at the end of the bridge, where it turned at right angles on reaching the left bank. Cassio,⁴ expressing yet a third opinion, attributes it to the Claudia; while Gori, perceiving it to be a good deal higher than the Marcia and the Claudia, thinks that the main conduit of the Anio Novus recrossed the river here, after approaching the other two aqueducts to supply them in case of need. The actual remains are a tiny fragment of concrete in a field immediately below the modern road, and a much larger mass of concrete in the bed of the Anio, on the right bank near the water's edge. The latter contains a portion of the *specus* and a part of the tile arch which supported it. The work is late and bad, the tiles in the arch being thin and badly laid, and the outer walls faced with rough fragments of stone: and there is no trace of the reticulate work seen by Revillas. The *specus* is 1.43 m. wide and the *specus* walls 0.80 m. thick: the direction is 60° E. of N. The levels suggest that its correct interpretation is a branch from the Anio Novus to the Marcia, which exists in the bank under the road. The ruins are marked so prominently in the staff map as *Ruderi di Ponte Arconi* as to suggest that more was preserved fifty years ago; but they were not described by Lanciani.

South of the railway bridge on the line to Subiaco, the *specus* of the aqueduct is accessible, at a point where a late branch returns to the main channel, now running south-west. The actual divergence cannot be found without excavation: but, when the main *specus* is entered, the branch can be followed back for some way,

Regionis amplitudine, in incerto propterea locum originis, seu Formae ipsius Aquae Augustae, quatenus de Frontini Augusta loquerenter, et sub nostro ratiocinio, et probationibus relinquunt. Quinetiam praedictas Bullas procul ab his circa XXXVIII lapidem locis utramque Aquam amovere, et ipsi Monasterio approximare patet.'

¹ *Vat. Lat.* 9024. 134. Cf. his notes at the British School, which are another rough copy of the same treatise.

² The words are *arcuum crassities*: this cannot mean the width of the aqueduct, for it does not allow enough thickness for the *specus* wall: and from the context it seems to mean the span.

³ In his notes at the British School he says 4 feet.

⁴ *Acqua Marcia*, 72: 'poco lungi (da Roviano) si veggono le vestigie di un ponte arcuato laterizio, detto ponte d'Arco, il quale riportava all'altra sponda (sinistra) lo speco dell'Aniene nuovo che si va ad immergere nelle viscere della . . . montagna.' He then speaks of the supposed crossing higher up in the Terreno Vetoli, and goes on: 'Ma perchè gli antichi fecero tragittare due volte all'Aniene nuovo il fiume in questo luogo? Io credo che fosse per soccorrere di acque i condotti della Marcia e della Claudia.'

where it runs practically parallel to the main channel, and, after one or two turns, finally enters it by a rough hole in the direction 20° S. of W. The main channel, 0.90 m. wide, has a round vault, and is in rough concrete: the branch, 0.95 m. wide, has a pointed roof, and is faced with inferior thick bricks, probably not later than Claudius.¹ The intrados of the round vault is at 312.72 m.; that of the pointed roof at 312.83 m. (I. 72). The hill-side now becomes steep, and the aqueduct, with a *puteus*, may be seen running along it: indeed, a landslip has exposed a part of the *specus*, visible from across the river, but inaccessible.

A little farther on, where the Anio bends below point 362 on Map 7, there is a new house, below which the *specus* is again accessible (I. 71). The brick facing has been robbed, but two triangular bricks lying there were undoubtedly of Claudian type.

Before the footpath is reached, the *specus* appears in a hole in a corn-field (I. 70), and opposite the south end of *casello* 56.257 a small stream cuts through its lower part, just below the path (I. 69). Its bottom is of concrete, resting directly upon the rock; and almost immediately the outer wall, of late *opus mixtum* with buttresses, appears just above the path. From this point, until opposite the mill at 303 m. above sea-level on the farther bank of the river, that is, nearly 600 m. north-east of Mola del Raio, there are remains of the aqueduct along the path (I. 68). At the southward turn, the *specus* is still visible; but, farther on, only one wall, again in *opus mixtum*, is seen following round the valley to the east of Molino del Raio. Some 150 m. to the ESE. of this mill, at the edge of a wood, the *specus* comes to light once more, lined with rough original concrete; it can be followed underground for 100 m. or more round the slope, first south-west and then nearly south (I. 67). About 100 m. farther on the Fosso Riorone descends from the hills crowned by picturesque Saracinesco; and to the west of it, just beyond the large spoil-heap from the modern electric conduit and below the present path, one can still see the lower wall of the *specus*, of concrete faced with *opus mixtum*, supported by buttresses, and within it the original construction, covered by the later channel which roofs it over entirely. The aqueduct now turned sharply from 20° S. of W. to 40° W. of S., opposite *casello* 54.480. The path has been destroyed, but the *specus* can still be seen, with rounded roof, 0.47 m. thick; the impost was 0.17 m. wide, the walls 0.60 m. thick (I. 66), with a cement lining 0.03 m. thick. At the south-west end of this stretch was a rectangular *puteus* 1.15 m. long. This piece, or another close to it, is indicated in Fabretti's map.²

¹ As Dr. Van Deman thinks.

² *Diss.* ii, tab. i, no. 8, *Aquaeductus, ad latus boreale montis sub Saracinesco*. At the top

Until recently, scanty traces were next visible in a tiny stream which has come into existence since Roman times; while just above the mouth of Torrente Licenza, a wall of *opus mixtum*, running 20° W. of N. now for 4 and once for 7 m., may represent a buttress supporting the *specus*. About 150 m. before the new bridge across the Anio to the Galileo Ferraris power-station, below *casello* 53.937 and opposite the path to Mandela, there is a piece of the original aqueduct just below the path, faced with *opus reticulatum* and buttressed; the intrados was levelled at 298.51 m. (I. 65). Down-stream of this bridge, a supporting wall in concrete is also visible in the bank of the Anio.

Opposite the railway-station of Mandela, the bank makes a sudden drop, exposing the sides and bottom of the *specus*. It was running north-east and was about 1.05 m. wide, with a quarter-round cement moulding, 0.15 m. wide and high, in each of the lower angles. The bottom, levelled at 288.44 m. (I. 64), was well cemented and rested on a base 0.44 m. thick. The concrete of the sides was very rough. The level ascertained showed that there was a very considerable fall from the last point, on which recent diggings for the electric works have thrown further light by discovering an intermediate sector, near the engineer's house. The *specus* was 1.25 m. wide, built in bad late brickwork, running 35° W. of S. Ing. Francesco Fontana was good enough, on the occasion of one of my visits there, in 1923, to take the levels himself. He determined the bottom at the upper end as being 295.890 m. and at the lower as 289.086 m., a difference of 6.804 m., i.e. a fall of 1 m. in 16.46, or 61 ‰. The rest of the fall (0.87 m.) occurred in the remaining stretch of 113 m., giving a gradient of only 7.7 ‰. Two hundred metres farther on, close to the south bank of the Anio, up-stream of the mouth of the Torrente Fiumicino, there are lengthy remains of the aqueduct, probably original but restored in brick-faced concrete and in great part destroyed by the stream. The south wall of the *specus* is now 1.50 m. high, but its foundations have been dislocated by tree-roots, so that its exact level is not certain.

The construction of the hydro-electric dam at the gorge of S. Cosimato has led to a considerable rise in the level of the Anio for some distance above it. This submerged the buttressed rough north wall of the *specus*, or its supporting wall, formerly visible some 350 m. down-stream of Torrente Fiumicino, and about 40 m. up-stream of the *casello* 53.222, on the opposite bank. It may now be seen at the very edge of the river, and its external reinforcement of the *puteus* on its south-east wall is a pipe-hole 0.05 m. in diameter, 0.75 m. above the vault of the aqueduct: its purpose is uncertain—it is so high up that it cannot be a derivation and looks as if it must have brought water into the aqueduct from some spring, improbable though this seems. The pipe itself is gone, if there ever was one there.

has fallen away, disclosing *opus reticulatum* with brick bands, probably Hadrianic, but impossible to examine closely. Twenty-five metres farther down-stream is another piece of wall, faced with bad brickwork below, capped by one course of small rectangular blocks of stone, followed by unfaced concrete, huge blocks of local limestone (one measuring 1.80 by 0.65 by 0.90 m.) and brickwork again. This mixed facing must be very late. At the upper entrance to the tunnel of the power conduit, the extrados of the aqueduct was formerly visible. A recent fall of earth has also revealed the round-topped vault of the underground *specus* a little way down-stream; and some Hadrianic brickwork may be seen a little way beyond. Close by, just before the later branch of the Claudia¹ crosses the gorge, the intrados of the *specus* was levelled at 288.44 m. (I. 63). The *specus* is here 1.18 to 1.20 m. wide, with a pointed top, and is built of coarse concrete, without facing or lining, probably original. The deposit is foul, almost black, and very hard.

The bottom of the *specus* of the Anio Novus was found at the lower end of the Galleria di S. Cosimato, up-stream of the bridge for the power conduit (I. 62). A long stretch in rough concrete, partly cut in rock and partly laid in earth, has been grazed by the conduit, and may be seen in its upper bank; indeed, the engineers used it to level on. The next piece, no longer visible, was at 20° E. of S. of St. Mary's chapel in the cemetery of Vicovaro (I. 61): its deposit was stalactitic. The writer also saw it hereabouts in 1900, at first below the path, where were buttresses² of *opus mixtum*, and then in and above it. At 150 m. farther on, at the east end of the bridge by which the power-conduit crosses the valley opposite the cemetery (I. 60), the aqueduct may be seen again. It ran round this minor valley in a *specus* of concrete faced with bad *opus mixtum*, preserved for 17.80 m., and then, turning at right angles, it crossed a small bridge, now much ruined, faced with *opus reticulatum* quoined in stone and 3.60 m. wide excluding buttresses. At the west end³ (I. 59), the original *specus* is well preserved in the hill-side, being a typical underground concrete channel.

Before reaching *casello* 50.798, almost opposite the road bridge from Vicovaro, in the works for the power-conduit, the *specus* was found again (I. 58). It was also found behind, or east of, the *casello*⁴ on the south-west side of a small ravine, going 15° W. of

¹ The Claudia is here at a slightly higher level, in order to simplify the construction of its bridge.

² 1.80 to 2.35 m. apart, 1.80 m. thick, with a projection of about 1.40 m.

³ The point is rather loosely described as 'in front of *casello* 51.333' in *Livellazione*.

⁴ Here a villa with a black and white chequer mosaic of the first century A.D. was found, just east of the *casello*.

N.; it was 1.10 m. wide, with a blackish deposit in thin flakes, and the lower *specus* wall was supported by buttresses of rough, small blocks of *selce*, obviously late.

(b) *Vicovaro to Valle d'Empiglione. Maps 6, 7.*

In the immediate neighbourhood and south-west of the railway-station, both the Anio Novus and the Claudia are visible. The former lies some 8 m. above the railway-line. It was obviously constructed in cut-and-cover work; the *specus* is from 1.04 to 1.10 m. wide, with concrete side-wall 0.50 m., and 2.17 m. high to the spring of its round, concrete vault, some 0.50 m. high. It has been laid bare and largely destroyed by quarrying operations: it may be seen in section a few yards south-west of the station: and a length of about 20 m. may also be seen just before we reach the last quarry of all, on the north bank of Fosso Le Giunte, near to *casello* 50.351. In this last quarry another stretch, some 20 m. long, was discovered and destroyed about twelve years ago, almost continuous with the last; and a small piece of it may still be seen in the quarry (I. 57). There was a change of line here; the original *specus* was round-headed in rough concrete; but, at a *puteus*, 1.08 m. wide, faced with late brick-work, a pointed *specus* of brick branches from the left. In a hole beyond this point a *specus* 0.98 m. wide was found, with inner wall 0.67 m. wide set against a vertical rock-face. Above the *opus reticulatum* buttresses of the Claudia,¹ the bottom of the *specus* was found 278.07 m. above sea-level, which gives a fall of 1.70 m. in about 50 m. (70 paces) or 3.40 %. This piece seems to have disappeared. Its level forbids us to attribute it to the Claudia.

In Fosso Salone, some 50 m. above the Claudia and the modern conduit, are considerable remains of the Anio Novus. The arch over the stream has fallen, but the *specus* walls and buttresses in *opus reticulatum* with stone quoins may be seen on both banks. On the north-east bank is a small arch of late *opus mixtum* 0.90 m. in span. The aqueduct runs 35° S. of W. (I. 56).

South-east of the railway-bridge below Vicovaro, at the upper entrance of the tunnel of the power channel known as the 'Prima Galleria Alli', the *specus* was found and destroyed: its outer wall was of concrete with late brick-facing, and was² supported by buttresses. A few metres to the south-west and above the sub-structures of the Claudia (II. 30) the concrete of the Anio Novus was visible in 1915, its *specus* having been cut into in making the power-channel. Here it was unfaced and of the original

¹ See p. 202.

² I noted in 1900 that there were six buttresses and a total length of about 30 m.

construction (I. 55); some concrete faced with *opus mixtum*, seen lower down near the Claudia, had probably fallen from it.

In the next lateral valley to the south, opposite the tomb of Maenius Bassus, is a single-arched bridge of Anio Novus, about 40 m. above the Aqua Claudia; it is 6 to 7 metres in span and 3.05 m. wide, faced in late *opus mixtum*, with buttresses¹ on each side; and there are traces of earlier *opus reticulatum*. The bottom of the *specus* is at 277.77 m. and the external projection, apparently corresponding to the impost, is at 279.13 m. (I. 54), which makes the height of the *specus* wall only 1.36 m. from bottom to impost, much below the average. In a cutting of the power-channel,² the top of the *specus* was levelled at 279.10 m.

Farther along, the *specus* appears on the line of the hill-side path: some of the original brick facing is preserved, and some has been renewed in rough *opus mixtum* with buttresses. At one place, just above the portion of the Claudia shown in Pl. X b, there is a rectangular *puteus*, followed by a small outlet-hole either for distribution or, more probably, to allow surplus water to escape from the top of the *specus*. It can be seen again farther south, but, like the Claudia, begins to run underground.

In the Fosso della Vallana, on the east bank, there is a piece of the *specus* belonging to a late restoration. It is mentioned by a correspondent³ of Revillas, but not any one else. It is running ESE., the natural course to take after crossing the northern branch of the stream. Only a little piece of the NNE. wall is preserved, 2.60 m. in length and 0.59 m. thick, with a buttress, about 1.20 m. wide and 0.60 m. deep. It is in concrete and faced with *opus mixtum* (I. 53). It is interesting that the Claudia should have been made to cross this valley on a large bridge, when the Anio Novus, by being taken a little higher up, was able to avoid the obstacle entirely. But the difference was no doubt dictated by the initial levelling over the whole course.

After a tunnel some 700 m. long the aqueduct reappears in a small valley north of point 211, where a portion of its *specus* with a *puteus*, belonging to a late restoration, has been found. A level of 272.75 m. was taken on a projecting course, which seems to have corresponded with the impost. This is somewhat low when compared with I. 52, and is not printed in *Livellazione*. The

¹ That on the south projects 1.96 m.

² I cannot fix the point exactly, but it must be not very far from the beginning of the tunnel through Colle Stefano.

³ The description given is of an aqueduct about 5 palms (1.11 m.) wide with a shaft (perhaps the Anio Novus); 'dirimpetto a Sacco Muro al fosso detto degli Arci . . . si vedono tre acquedotti: il più alto tira verso libeccio, senza barbacani, largo 5 palmi' (the other two are the Claudia and Marcia). Revillas was obviously employing the writer to collect deposit for him from the various remains of aqueducts, in anticipation of Lanciani's methods.

specus has now been partially destroyed, so that the point cannot be exactly determined. Another 500 m. brings us to Fosso della Noce, where the bridge across this deep valley has almost entirely disappeared.¹ The aqueduct was again visible in the next gully, a little west of south of the railway-station of Castelmadama, winding round the hill; and was brought to light by the construction of the new power-house² (I. 51, 50). Originally it must have run as a hill-side or 'cut-and-cover' channel, visible at frequent intervals, for nearly a kilometre above the Anio, which is here running due west. At the power-house, the *specus* was running 30° W. of S. and was 0.95 m. (or more) wide, and almost entirely choked with deposit, each main layer having a thin black layer under it. The *specus* wall, 1.20 m. thick, was not lined with cement and belonged to a late reconstruction. Some 2.40 m. lower down the bank was another supporting wall 0.60 m. thick. In the vineyard west of the power-house the *specus* is seen again, but is constructed in concrete faced with *opus reticulatum* of tufa, with grey mortar, belonging to the original construction, with a pointed roof (I. 49). It is running 30° N. of W., but soon curves north to go along the hill-side in 'cut-and-cover' work. In the wood a little farther on it is running 30° W. of N. (I. 48). The *specus* is seen again at the top of the first bend of the road from Via Valeria to Castelmadama (I. 47). The outer walls, originally visible, are of concrete roughly faced; the roof is round and shows the impression of the planks on which it was set. Above it is concrete 0.65 m. thick, with a flat extrados, suggesting that the roof also was meant to be covered.

From this point the aqueduct keeps underground for about 600 m., until it comes out in the valley east of Fonte Luca, before the confluence of the two branches of the stream. In the northern branch its channel appears in a modern path, with a spring running through it; while the southern branch was spanned by a bridge of considerable size, though not so high as that of the Aqua Claudia (I. 46). It was originally constructed³ of *opus reticulatum*, with tufa quoins and voussoirs, and stone arches⁴ on concrete foundations at the crossing of the stream. There were probably two of these arches: but only the abutment on the east bank is actually preserved. In it, the courses of masonry are irregular in height: some blocks are bossed, with a smooth

¹ See pp. 205-6.

² This bears the name 'Centrale Idroelettrica Alessandro Volta': an account of it with some good photographs, from the modern point of view, will be found in *Capitolium*, ii, no. 5 (August, 1926), p. 277 ff. The aqueduct of the Claudia at Fosso della Noce can just be seen to the left of the bridge of the modern conduit, at the top of the illustration on p. 277.

³ See Plan, Fig. 26: and cf. Dr. Van Deman's detailed constructional discussion.

⁴ In one place we may note a relieving arch with tufa voussoirs above the real arch.

surface 0.10 m. in width; in others the bossing is irregular. There are also traces of this pier having been strengthened with *opus reticulatum*: a buttress (*f*) in that material extended along the face, except for 0.50 m. at the south end and 0.25 m. at the other end; and there are traces of concrete on the SSW. end, with debris lying near it, which come below the plan level. At two later periods concrete faced with bad brickwork was placed round the down-stream end of the first pier on the west side and underpinning the first arch; it also sheathed the greater part of the bridge and most of the buttresses. The *specus* was partly restored in similar brickwork: at *d* is a low brick arch inserted underneath it, while at *c* the original arch (5.65 m. in span) is filled up with brickwork: the brick wall shown on the plan is a low reinforcing wall, which does not come up as far as the *specus*. At the north end, on the west side, which has in great part collapsed, there is still later reinforcement (*e*) of concrete faced with rough pieces of tufa and limestone. Over the brick arch south of the stream are three rectangular slits, perhaps for sluices, in the west wall of the *specus*, 1.00 m. apart, about 0.20 m. wide and 0.10 m. deep. Just north of them are two small vent-holes, 0.30 and 0.20 m. in diameter respectively, which emerge at *a* and *b*; and to the east of this first arch is a huge mass of aqueduct deposit (see Fig. 26, *g*). The bridge is too much ruined to warrant an elevational drawing. Beyond the plan several buttresses are traceable on the upstream side, to south.

The aqueduct now ran in a tunnel, SSW. up the valley west of Monte Papese, and in the subterranean course of about 2 km. no *puteus* appears to exist.¹ It reappears some 600 m. east of Casa Maria, a farm-house on the hillock 256 m. above sea-level, about 350 m. east of *caposaldo* 221.² The *specus* is preserved for a length of about 90 m. under the edge of a wood, running in a south-easterly direction. It is of rough tufa concrete, without facing or lining, and may be assigned to the original construction. It is only 0.85 m. in width, and the *specus* walls are 0.60 m. thick: the roof is pointed, and was set on planks (I. 45).³ The narrowness of the *specus* here was exceptional: for in February 1911 the writer saw the *specus* running south-west by south in an

¹ The uncertainty that prevailed about its course is shown by the fact that Fabretti (67: 59 *Diss.* ii, tab. i, no. 5) marks the 'Ruderi di Saxula' (really of a large villa, a mile to the west of Ciciliano (see our Map 6) which is a long way to the east of the real line of the aqueduct) as 'ruins of a vast building, which perhaps lies above the channel of the Anio Novus, which comes out of the ground lower down, at the place marked 3' (i.e. on the south side of the Valle d'Empiglione).

² The *caposaldo* was placed on the fountain, which is really situated close to the westernmost, and not the easternmost, of the two red circles on the map.

³ The point is wrongly marked in the map: it should be about 200 m. farther north, where the hill-side runs in a south-easterly direction.

orchard not far off:¹ it had a pointed roof, and was of concrete, and about 1.05 m. in width. No deposit was to be seen.

From this point the aqueduct tunnelled under the watershed between the valley of the Anio and the Valle d'Empiglione, along which runs the path from Tivoli to Castelmadama where *caposaldo* 220 was taken, and reappears east of Colle Monitola near the head and on the west side of a small valley which descends southwards to the Osteriola. Where first seen, it brings water to a small modern fountain; but little is now visible, though I was told it was large enough to hold a man standing upright. A little farther down, up-stream of and close to a small house (*caposaldo* 219), its intrados is visible (I. 44); and some 100 m. farther again, where trees have been planted in the *specus*, it measures 1.15 m. in width and 0.50 m. from the impost to the intrados of the round vault, laid on planks. The concrete, probably original, is composed of friable dark grey mortar and lumps of tufa; and there is no trace of facing or lining. A little farther along comes a late *puteus*, 1.30 m. in diameter.

The aqueduct can then be followed along the bottom of the slope at the edge of the floor of the valley for about another kilometre. At first it is of rough concrete without facing, and levels (I. 43 and I. 42) show that the fall is rapid. After I. 42 comes a field-wall, dividing the orchards and gardens from the ploughed land; and a track descends to a bridge over the stream, cutting through the *specus*, 1.10 m. wide, where the deposit is very thick. The aqueduct then takes a sharp turn and continues to follow the hill-side, in a long stretch, still without regular facing on the inside; on the outside, it is faced with late *opus mixtum*, and has been reinforced once at least² (I. 41). After a break it reappears (Pl. XIX *a*, Fig. 30 *b*) and then turns to run WSW.

(*c*) *The loop by Valle Barberini to Fosso di Ponte Terra. Map 6.*

At the end of the little valley lies the modern high road from Tivoli to Ciciliano, which probably follows an ancient line. Here the *specus* divides³ into two channels (Fig. 27), one crossing Valle d'Empiglione in a southerly direction by a long line of arches,

¹ From the general line of the aqueduct, I should imagine that it was farther to the north.

² A drawing of the *specus* is given in *Livellazione* (fig. 42) showing the vault to be 0.60 m. high; while the depth from the impost to the bottom is conjectured to be 1.68 m., which would put it at 251.76 m. This, however, will not agree with the fall given from this point to I. 40 (2.59‰ or 1.23 m. in 475 m.), where the bottom was levelled at 249; and probably the *specus* should be taken as being a good deal deeper, the bottom being at 251.14 m., which would give a depth of 2.90 m.

³ At the point of divergence above the branch going westward, there is a mass of brick-faced concrete, some 3 m. square, which does not seem to be connected with either aqueduct, though it has been thought to be a clearing tank. The *specus* was cleaned out for a length of 6.50 m. and a door built in 1838, *Atti Camerleng.*, tit. iv, fasc. 2820.

the other turning west, crossing a small lateral valley by a brick bridge, and continuing to Ponte degli Arci. Before this was observed, and before the close dating of styles in construction was attempted, the natural explanation, adopted by Lanciani and others, was that the original Aqua Claudia went by Tivoli, but has now entirely disappeared till beyond the town (II. 19); that the channel, which runs across Valle d'Empligione, led to the

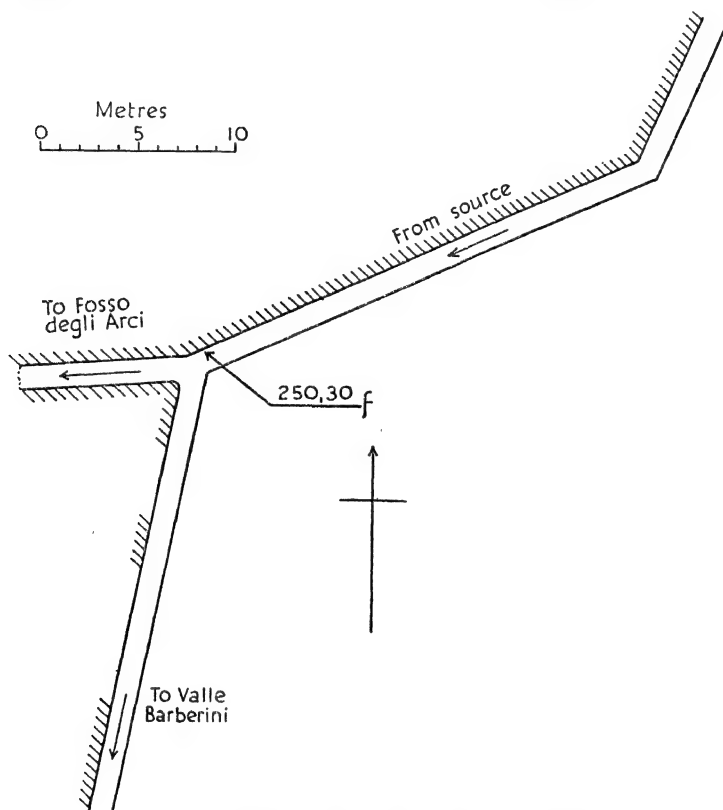
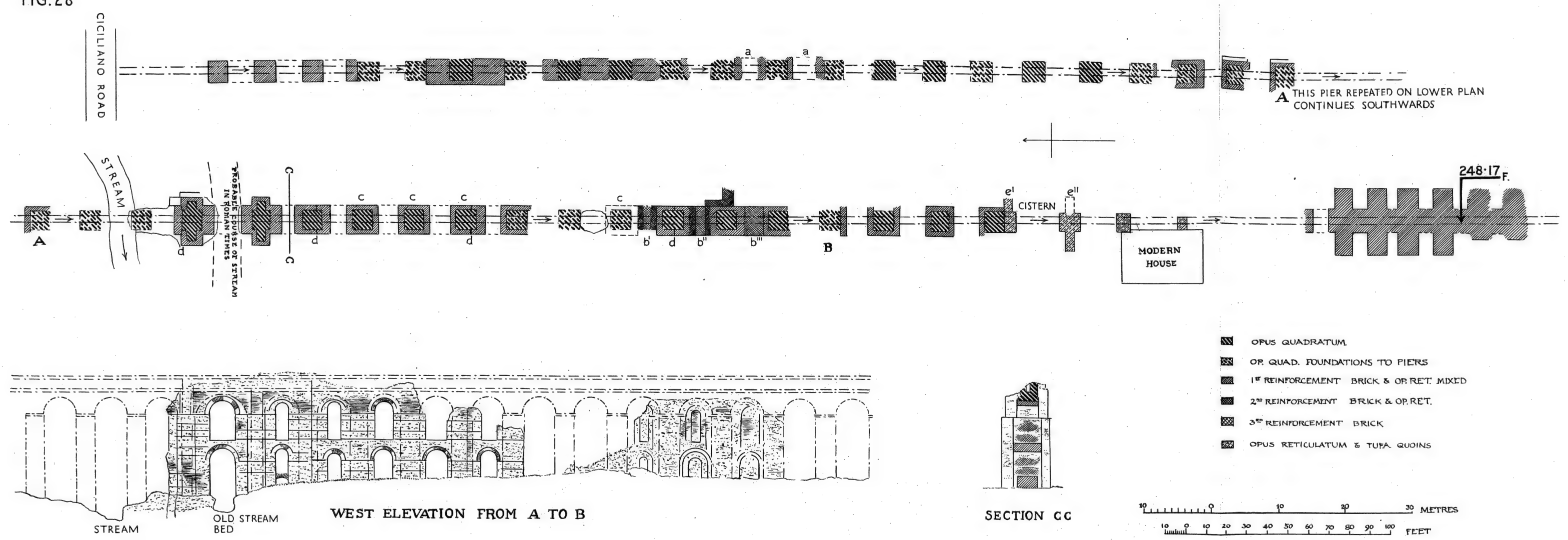


FIG. 27. Division of the Anio Novus at Osteriola.

tunnel of Paquedius Festus (*rivom sub monte Aeflano*), built in A.D. 88, the original line being then allowed to fall into disuse, which would explain its non-appearance; and that the Anio Novus crossed Ponte degli Arci. The first flaw in this hypothesis is that the channel crossing Valle d'Empligione is a branch from quite another aqueduct, the Anio Novus. Secondly, this line of arches is not Domitianic, but undoubtedly belongs to Claudius.¹ Original work is also to be found both here and in the channel of Aqua Claudia along Via di Carciano (II. 16-19). Thus the inscription of Paquedius can only refer to the boring of a new tunnel or

¹ As Dr. Van Deman and myself agreed, after a prolonged joint study of the problem.

FIG. 28



ANIO NOVUS IN VALLE D'EMPIGLIONE

to the laying of a new channel close by one of the two already in existence.

The arches¹ themselves (Pl. XX *a*) begin on the north of the road, with a few low arches originally built in ashlar, and later reinforced in concrete which seems Hadrianic.² There is a break at the modern road, where must have been an arch over the ancient road which it follows (Pl. XXII *a*); and south of this break our plan (Fig. 28) begins.

Now follow three piers and part of a fourth, with three arches in concrete, faced with very fine work in triangular bricks; these piers, being too thin to conceal ashlar masonry, must be a reconstruction; also assignable to Hadrian. The facing has been almost entirely removed for building material, even along the exterior of the *specus*, which was slightly narrower than the piers. There are bonding-courses of thick *bipedales*, 1.47 m. apart; the arches have a double ring of voussoirs, and a cornice at the impost. The next piece is much ruined, with original ashlar masonry frequently reinforced with brick-faced concrete and (at *a, a*) with two low arches.³ Close to the stream⁴ another piece of the concrete casing is standing, in which the impressions of the ashlar blocks are also seen.

On the south bank of the stream the aqueduct is far better preserved (Pl. XXI *a*). It was built originally in tufa ashlar,⁵ including the *specus*, but has been reinforced in concrete, faced with Hadrianic brickwork interspersed with bands of *opus reticulatum* and marked by brick impost-strings (Pls. XX *b*; XXI *b*). This reinforcement⁶ has a double tier of supporting arches inside the original single stone arches, and has completely encased the piers, but its facing has been almost entirely removed. Vertical joints, to be seen at four points⁷ (*d, d, d, d*) simply mark the meetings of different gangs of builders, who spaced their bonding-courses at markedly different intervals, though the style of the concrete and

¹ See Cassio, *Memorie di S. Silvia*, plate opp. p. 87 (where *L* and *M* are erroneously described as fragments of other aqueducts going towards Tivoli); Canina, v. 145, vi. 143; Nibby, *Schede*, ii. 43, 44, adds nothing.

² *CIL*. xv. 2382a. 1 (not after Trajan or Hadrian) was recorded by Fabretti as having been taken *ex arcubus Anienis Novi, III m.p. supra Tibur*, i.e. here rather than at Ponte degli Arci, which is not more than a mile and a half from Tivoli. Dressel points out (*in loc.*) that *ibid.* 575. 24, however, should not be attributed to this aqueduct, being given by Fabretti as of unknown provenience.

³ So low are they that there must have been other arches above them.

⁴ Just to the west of the crossing there is a low pier of ashlar 3.90 m. wide, probably belonging to a road-bridge going 15° E. of S. Cassio, i. 153 attributes it to an aqueduct.

⁵ The blocks are carefully jointed and draughted: they measure 0.60 to 0.73 m. high, and are irregular in length.

⁶ At various points *c, c, c, c*, this brick-faced reinforcement has fallen since the plan was made, and exposed the ashlar masonry—largely owing to the action of roots of trees.

⁷ In all but the second the cornice was actually built round the pier by the first of the two gangs, and was left in the filling by the second gang—no doubt as a key.

of the facing is identical. At b' and b'' , the two arches of this reinforcement have themselves been underpinned with concrete faced with brick and *opus reticulatum*, making two arches of smaller span; and these smaller arches were in turn filled with brick-faced concrete; while at b''' , where no second reinforcement is to be seen, both arches of the first reinforcement have collapsed, so that the late brick-faced filling goes right up to the top. Farther on (at e'), concrete faced with *opus reticulatum* is set against a pier of ashlar, in such a way as to prove them contemporaneous.¹ At the south end masonry is not used at all, the work being all in concrete faced with original *opus reticulatum* quoined in stone, against which a modern house is built. After an interval of 18 m., there is concrete faced with brickwork of the Severan period, with buttresses; the first interval is pierced by an arch, and there may have been others: and then, beyond the extreme limits of the plan, *opus reticulatum* occurs again. At this point the *specus* is seen (I. D, s), lined with rough concrete; the deposit is only 0.015 m. thick, suggesting that this part of the aqueduct either had been cleaned shortly before its abandonment, or was, in later days, far less used than the branch which passed by Ponte degli Arci.

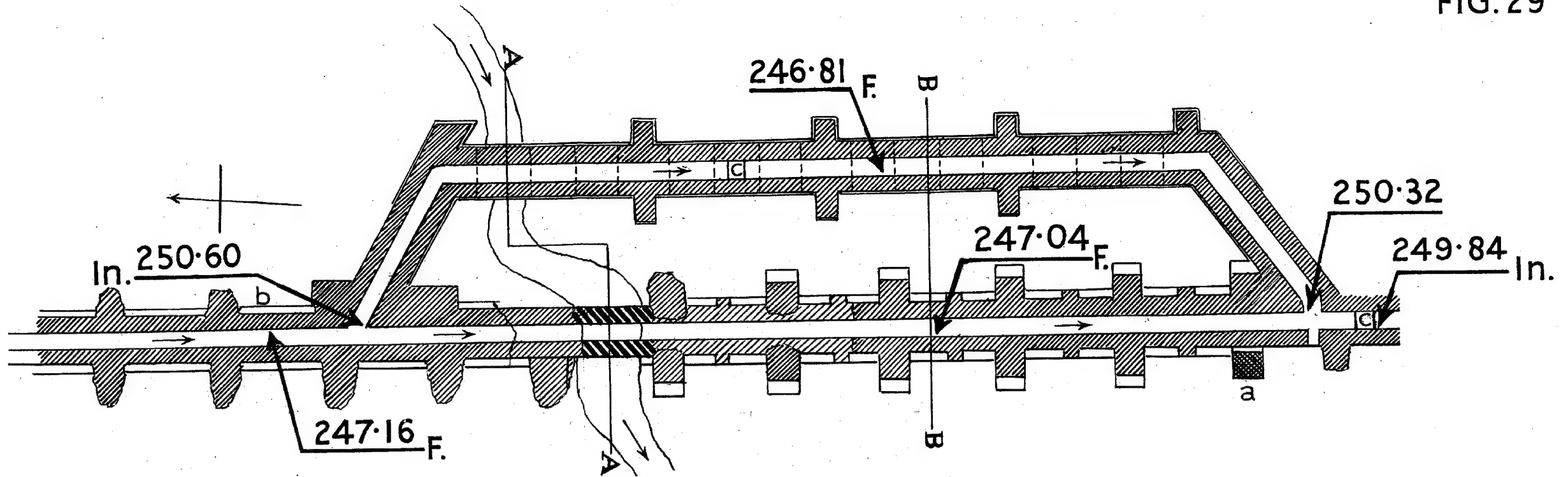
South of Colle Castello, which is traversed by a short tunnel, in a small dale called Valle Barberini and watered by a short tributary of Fosso di S. Gregorio, is the best instance in the course of these aqueducts of an alternative channel (Fig. 29). Both *specus* seem to have been maintained to the last, and there is no sign of either having been put out of use. Canina² gives a drawing of this portion of the aqueduct, which he interprets correctly. Its purpose was either to enable a repair to be made in the channel without interrupting the flow, or, as Lanciani thinks,³ to act as a discharge, in case the long tunnel which the aqueduct shortly entered needed cleaning. The original structure was the straight channel, crossing a single-arched bridge in tufa ashlar (section AA), quarried close to the spot, in the hill-side at the north end of the bridge. The solid approaches are in concrete faced with *opus reticulatum*, of which the *specus* also was probably built. Some *opus reticulatum* is indeed preserved at b , on the east side at the north end, and on the west side at the south end, beyond the limit of the plan: and there is a shaft in the channel (c) just beyond the junction of the alternative *specus*. The whole structure was later encased in concrete, faced with brickwork down to the bottom of the small buttresses, and *opus mixtum* (two bricks to

¹ Between the piers e' , e'' on the east side there was obviously a cistern inserted for a branch supply: some of its cement lining, 0.05 m. thick, is still preserved.

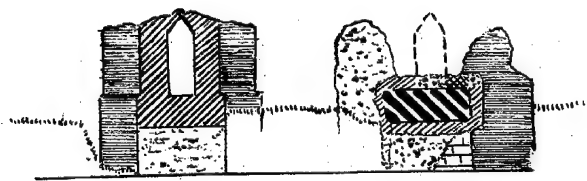
² vi. 153; cf. v. 145.

³ Lanciani, 137: 349.

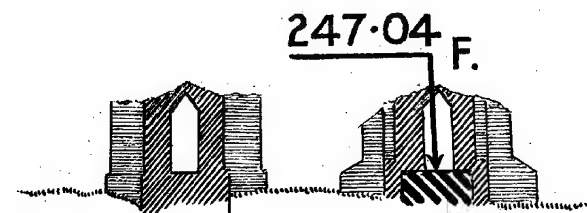
FIG. 29



ANIO NOVUS IN VALLE BARBERINI



SECTION A-A

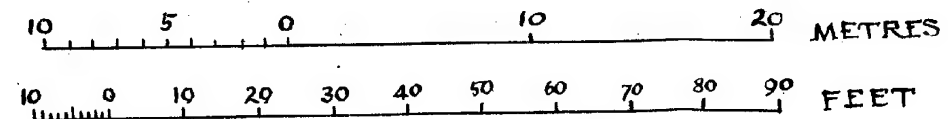


SECTION B-B

- OPUS QUADRATUM
- BRICK FACING
- OPUS MIXTUM

C SHAFTS

DOTTED LINES IN EAST WALL SHOW ARCHES BELOW



one block of tufa) below this level, while the *specus* and much of the rest are restored in this material. The brickwork is good and probably Hadrianic.¹ The buttresses of the reinforcement are alternately large and small; one on the west side (*a*) is entirely of *opus mixtum*.

How the alternative *specus*, in greatly inferior brickwork, leaves the aqueduct at the north end is not certain; at the south end it re-enters by a break in the wall of the older *specus* without any actual trace of a trap or sluice, though there is a break in the roof just before the junction, where a sluice-gate might have been fitted, and also on the west side, opposite the junction, while there is a shaft (*c*) in it near the middle. Neither *specus* retains any deposit. They are respectively 1.14 m. and 1.17 m. wide; both have pointed roofs of concrete, moulded upon short planks.

In the next valley to the south, that of the Fosso Tufali,² or Valle Lungherina, the embankment wall of brick-faced concrete on the lower (west) side of the *specus* can be traced for some distance, until the aqueduct disappears under the hill. Lanciani gives the level above sea as 255.70 m., making the fall from Colle Monitola 10.75 m. in 2,300 m., or 4.68 ‰. The length of the tunnel that follows is computed by him as 4,950 m. to Ponte S. Antonio, over Fosso dell'Acqua Raminga: but this distance is too high, for substructures are traceable some 600 m. farther south than he indicates, though no precise level can be obtained anywhere, and the aqueduct emerges far sooner than he supposes. The map suggests a tunnel 2,250 m. long. Accepting this, the fall is 6.71 m. from the impost at the south end of Colle Castello bridge (249.84 m.) to the impost at the piscina (*caposaldo* 147: I. 26), which is at 243.13 m., that is, 2.96 ‰.

(*d*) *The loop by Tivoli to Fosso di Ponte Terra. Maps 5, 6.*

Returning now to Osteriola and the west loop, it may be seen that immediately after the divergence the *specus* is choked by deposit to within 0.50 m. of its intrados. It is here 1.22 m. wide, and measures 0.60 m. from impost to intrados, giving a total height of 2.20 m. or more. The accompanying photograph, taken by the late Mr. J. H. ten Eyck Burr, illustrates it well (Pl. XIX *b*; Fig. 30). The *specus* then runs along the hill-side. It is in concrete faced with brickwork of post-Severan type. It soon passes across a lateral valley, to the south-east of the house marked 26 (which is built upon an ancient reservoir with four chambers) by eleven arches in brick-faced concrete (Pl. XXII *a*), with no

¹ As Dr. Van Deman suggests.

² It is called Fosso Scarabazzo in the earlier edition of the map.

trace of earlier construction, except original *opus reticulatum* cubes in the concrete. The brickwork is of the same period and character as that of the substructure immediately preceding: there is a brick mould at the spring of the arches, turned in ribs of tiles at intervals, and double rings of tile-voussoirs. The foundation of the abutment is exposed at the east end, showing

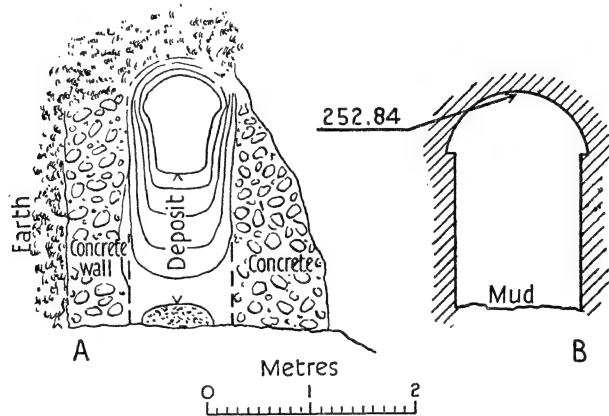


FIG. 30. Choked channel of Anio Novus at Osteriola.

that the slope of the ground has changed somewhat since ancient times. There is a slight increase in thickness at the beginning of the series of arches,¹ and another at their western end: but the cornice which marks the bottom of the *specus* is continuous. The huge mass of unstratified deposit at the west end, on the north side, is due to an overflow.

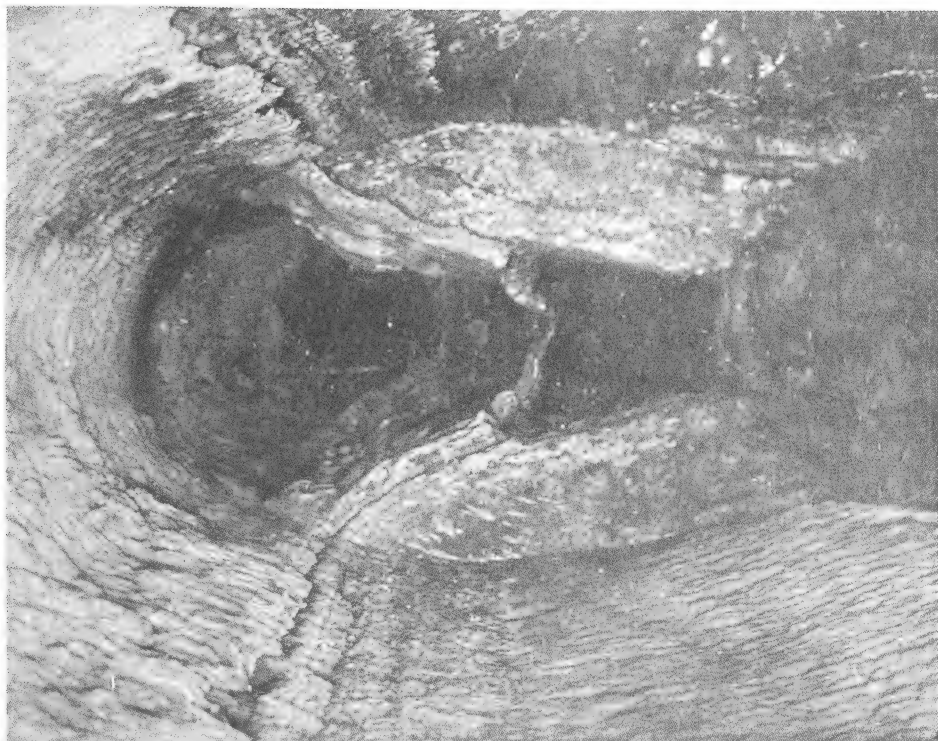
The aqueduct then runs underground for some distance, and emerges again a little east of the point where the boundary between Tivoli and Castelmadama turns northwards from the modern road and climbs the ridge between Valle d'Empiglione and the Anio. It runs in a westerly direction, the top of the *specus* being only just above ground-level (I. 38). The period of the work is the same as before. At one point there are several buttresses, and beyond them, where the concrete of the roof, set on planks, has disappeared, the deposit has almost choked the channel, and has taken an accurate impression of it.² In one place

¹ The fact that the facing has entirely gone on the north side and under the arches, though fairly well preserved on the south, is probably due to the fact that on the former (which was in a different property) it was removed for building material.

² 'The *specus* reappears on the edge of the spur between the Valle degli Arci and the valley of the Anio. . . . This stretch, 320 m. long, is most noteworthy, for the form of the *specus* is preserved, not by the side-walls and the vault, which are destroyed, but by the deposit. . . . The channel is filled up for about three-fifths. I have noted that the face of the strata of deposit nearest to the edges has been removed with a pick, which shows that in the best days of the Empire the channel was periodically cleaned out.' *Lanciani*, 142 : 354.



a. ANIO NOVUS: ROCK-HEWN CHANNEL AT FOSSO DELLA



b. ANIO NOVUS: ROCK-HEWN LOOP-CHANNEL AT

the deposit has run right up through a rectangular *puteus*, which measures 1.15 m. longitudinally. At 1,200 m. from point I. 39, the intrados of the *specus* was levelled at 251.30 m. (I. 37); in the section in *Livellazione*, 1.36 per 1,000, or a fall of 1.72 m., is given, which means that the *specus* has been reckoned here as being 3.19 m. high.

About 320 m. farther on the aqueduct approaches the Valle degli Arci, a tributary of the Anio, and crosses it by the Ponte degli Arci (Pls. III *a*, XXII *b*; Fig. 1). There are smaller bridges of the Anio Vetus and Marcia, making a picturesque group¹ of ruins, easily accessible from Tivoli and frequently drawn by artists.

The bridge of the Anio Novus begins with a long substructure of post-Severan brick-faced concrete, the north side of which is at first built against the hill-side. The *specus* here measures about 2.30 or 2.40 m. to the impost, another 0.30 m. to the intrados, and is approximately 1.30 m. wide. It is almost entirely choked with deposit, where a modern house is built against the aqueduct (I. 36). At 1.30 m. west of this house there is a vertical break at *e*, followed by grey concrete for some 7 m. on the south side, when the red concrete begins again. This patch of later work is not seen on the north side, where grey concrete seems to run all through; and the brick facing is also better, being good Severan work with tile ribs in the arches, and moulds at the imposts and above and below the *specus*. Inside the arches we see some especially fine bricks in the piers.

Nine arches now follow, though much of the facing has been stripped off. The *specus* is here at least 1.15 m. wide and of considerable depth (3.50 m. or so); the deposit on each side is 0.35 m. thick. The first arch of all, immediately after the house, is blocked with still later brickwork;² while the fifth arch is filled with late rough concrete to no great height. After a slight change of direction, the ground falls, and the arches increase gradually both in height and span; they have double, and even triple, rings of voussoirs, and the extrados has a line of tiles set round it. The last pier preserved has a base partly built in tufa ashlar,³ probably original. This is the only piece that survives, and no

¹ It may be noted that there is a view of it in an unexpected place, Gamberini and Chiesa, *Cagioni e rimedi delle inondazioni del Tevere* (Rome, 1746), p. 104; the artist is unknown to me. Cf. Rossini, *Contorni*, 27; Gmelin, *op. cit.*, 6; Canina, *Edifici*, v. 145, vi. 144; Lanciani, 142 : 354. Cf. also Nibby, *Analisi*, iii. 228, *Schede*, ii. 42. It has recently been cleared of the vegetation, which, while adding to its present beauty, would in the end have proved fatal to its stability.

² Here the purpose of the filling is clear: the deposit shows a leak from the *specus*, which the builders tried to stop by filling the arch—but the leak continued along the joint.

³ It is not so heavily bossed as in the bridge which crosses the Valle d'Empiglione, but it is not certain whether any of the original outer surface is preserved.

trace of the arch remains. The next pier has fallen, but fragments of it lie on each side of the line of the aqueduct; beyond it only foundations and the debris of fallen piers (*b, b*) exist; in the lower pier on the farther bank there is ashlar still preserved. According to Mr. Newton's suggestion for a restoration, the stream was spanned by five ashlar arches, four originally in two tiers.

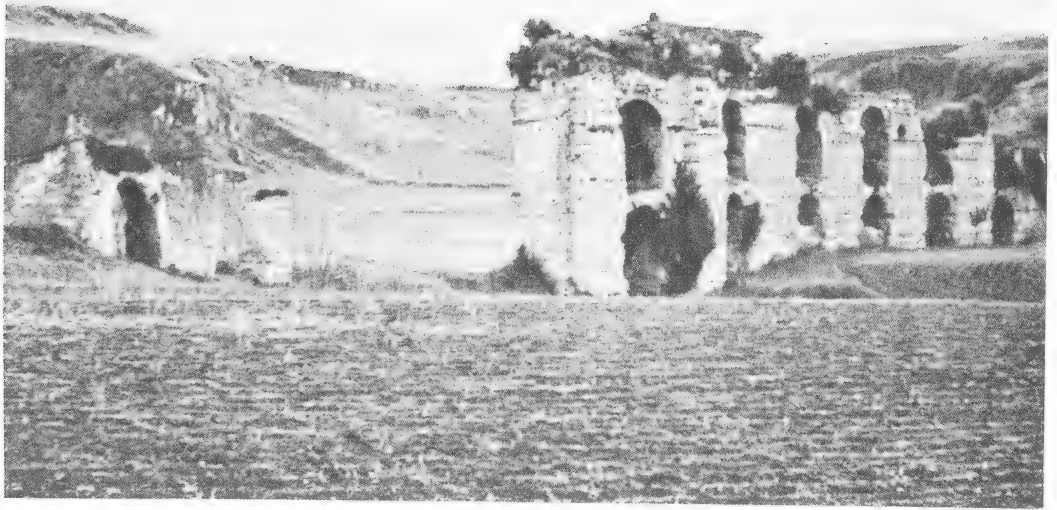
Two concrete piers in the stream-bed, just south of the line of this bridge, and one in each bank (*a, a, a, a*), probably belong to a late low-level road-bridge. One of those on the left bank has a curved cutwater and is faced with rough concrete above and late brickwork below; the next to the north-east also has some brickwork in it. Three are seen in the elevation. Again, at *c*, there is a concrete pier of a still later bridge, for the stream seems to have given continual trouble, demanding replacements of the original crossing, which lay between the Marcia and Anio Vetus. The modern road crosses still higher up, beyond the limits of the plan, and passes through the last arch on the farther bank, which is still standing, and is surmounted by a medieval tower (Pl. III *a*). It is clear that a stone pier was once supported by the north-east pier of concrete, for the springing of the arch towards the north-east is clear. It looks as if the two courses of limestone ashlar on each side had served as the base to the piers, for below them the opening narrows considerably (see Fig. 1). The concrete which underlies them on each side is to be considered as belonging to foundations below Roman ground-level.¹

The *specus* is not well preserved on this arch; but the deposit of the sides is still visible under the tower, and a little brickwork also. It is no less than 1.55 m. wide just outside the tower, on the south-west, and the bottom is 15.61 m. above the modern road (I. 35).²

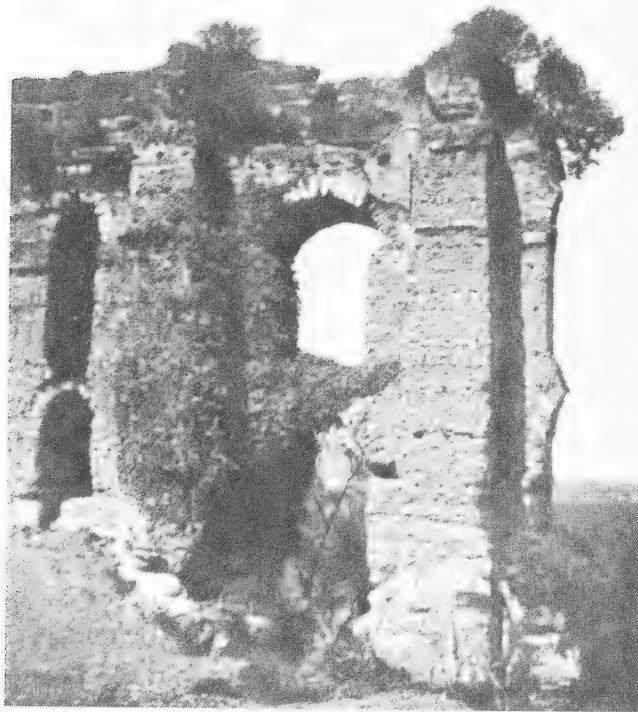
The *specus* then entered the hill-side, and must have turned at right angles almost at once. It was probably conveyed round the hill in a 'cut-and-cover' channel, but does not reappear until after the

¹ The modern road is now about 3 m. lower. Some post-Roman concrete on the south-east side of the south-west pier has been purposely omitted from the plan.

² 248-48 on *Livellazione*, fig. 40, must be an error. This conspicuous ruin naturally attracted a good deal of attention from the local inspectorate of antiquities since the reorganization of the administration after the famous Editto Pacca. Cardinal-Chamberlain Meom acted with considerable energy, as the *Atti del Camerlengato* now in the Archivio di Stato testify, and encouraged his subordinates to do the same. Thus, we have a letter from Giovanni Maggi, the inspector at Tivoli, dated 5 Nov. 1828, recommending repairs to the pier on the right of the main arch, estimated to cost 9.44 scudi, which were duly passed, *Atti*, tit. iv, fasc. 941; and on 10 April 1826, Maggi reported that the workmen of the Presidenza della Comarca had excavated at the foot of this pier for material for road mending, which rendered a repair necessary. Action was taken, and the Archaeological Commission, in a strongly worded report, insisted that the Comarca should take care that such damage did not occur again. *Ibid.*, fasc. 2476. In *ibid.*, fasc. 2983 the construction of a supporting wall to the Aqua Marcia in 1847 is mentioned.



a. ANIO NOVUS: HADRIANIC LOOP IN VALLE D'EMPIGLIONE



b. ANIO NOVUS: HADRIANIC LOOP IN VALLE
D'EMPIGLIONE, AT THE STREAM

northern spur of Monte S. Angelo in Arcese, where the aqueduct had to cross Fosso Arcese. Here is a well-preserved Severan bridge of seven arches, with abutments at each end, in all 4.20 m. wide (I. 34). There is no trace of restoration: but some concrete noted in the stream, some 6 m. north of it, may belong to an earlier bridge. About 20 m. to the north of the west end a rectangular shaft, probably Claudian, was seen some years ago, but has since been filled with rubbish. It probably conveyed water to the Marcia (III. 18) in case of any deficiency in the supply. The *specus* reappears on the west side of this valley as a hill-side channel, just above a hay-barn east of the Casa Colonica Luciani, about 250 m. east of the cemetery, a little above the modern road. It is of rough original concrete, and filled with heavy deposit, which runs up to and over the rounded vault (I. 33). West of this house, in a field on the right of the path, the intrados was levelled at 250.37 m.,¹ but only a hole leading into the channel can be seen.

In the next small valley to the west, behind the cemetery of Tivoli, some 400 m. to the south of the eastern part of it, a portion of the *specus* was observed in 1915. It was in concrete lined with Severan brickwork, and had a pointed roof (I. 32), but had vanished in 1928. From this point, it ran north-west along the slope of the hill and is not visible in the area behind the western part of the cemetery. About a kilometre north-west, under the west end of a house belonging to Signor Gervasio Ciotti, the channel is seen again; the lining is similar to that just described,² but as the channel was full of water in 1915, it was impossible to take its level. It is running 17° W. of N., and can be seen again on the hill-side in the olive-yard, some 100 m. north, where it has recently been cleared out and is accessible for over 10 m.³ It is again of the same character, with a rounded vault, set on planks, 0.70 m. high. It then turns to run 20° N. of W., and is blocked up after about 5 m.

From this point there is no further trace before Tivoli, where the exterior of the hill-side *specus*, in concrete, has recently been laid bare by a fall of earth at the north extremity of Colle Ripoli, just outside the walls, between Porte S. Giovanni and S. Croce, before reaching the fine castle of Pius II. The map shows it a little too far to the south. After passing this point it turned almost due south, and ran in a nearly straight line along the slopes of Colle Ripoli for rather more than a kilometre in 'cut-and-cover'

¹ *Livellazione*, p. 51. 25° SW. (the direction in which the channel was running) 'nel medicaio Luciani a destra del sentiero', 250.37 m.

² The width (1.30 m.) is slightly greater here.

³ This piece had not been cleared in 1915, so that no level was taken.

work. Here it was seen in the eighteenth century at three different points,¹ and is still visible in all of them. The first point is immediately east of the Riformatorio, a large white building² just to the south of the autobus station, where a *puteus* has recently been discovered, in the garden of Sig. Bernoni: it is rectangular, measuring 1.04 m. in length and is lined with Severan brick-facing, in which are the usual footholes. The *specus*, entered by a modern passage, has been cleared out within the last few years and the deposit removed for a distance of about 25 m. to the north and south: it has concrete walls 0.90 m. thick, lined with brickwork on the inner side, but left rough on the outer side, where they come against rock or earth.³ Where it has not been cleared out, no less than seven different strata of deposit may be seen, which reduced the bore to 1.45 m. in height and 0.70 m. wide.⁴ The second point is some 600 m. farther on, at Villa Braschi,⁵ in the cellars of which the channel (a tunnel cut in the rock and lined with brick-faced concrete) may again be seen. There is another *puteus* 1.10 m. long, similar to that described above, and the *specus* is of the same type and date; it had been cleared of deposit, which had narrowed the channel to 0.80 m. high by 0.60 m. wide, for about 100 m. in all. The third point is the cellars of the summer residence of the Irish College,⁶ rather less than 200 m. farther on, where it has been completely cleared and cemented in modern times. It runs first parallel to the front, due south, then changes its direction and turns⁷ south-east, curving round the head of the small valley above the tomb. Just outside the boundary-wall of the villa it is to be seen on the north side of the bend of the modern road to S. Gregorio, and fully 5 m. above it, for a length of 30 m. The channel (I. 31) has an external facing of late *opus mixtum*; the interior is lined with late

¹ Cabral and Del Re, *Ville di Tivoli*, 200. 'Da quest'arco (Ponte degli Arci) passava l'acqua Claudia (*sic*) a costeggiare il monte Affiano e torna a potersi osservare entro la Villa del Seminario Romano (now the Riformatorio) in quella del Noviziato (now Villa Braschi) incontro alla porta della Villa del Collegio Greco (now the Villa of the Irish College) dopo d'essa sulla costa del Monte.' Cf. also Canina, v. 144.

² It was formerly accessible by a modern branch from the cellars of this building, which was originally erected by the Jesuits in 1729 as the summer residence of the Convitto dei Nobili in Rome, also called the Seminario Romano. (Bulgarini, *Notizie di Tivoli*, 108, 'vicino e dentro il medesimo esiste un tratto dell'acquedotto Claudio che serve di grotta'.) The Seminario of the diocese of Tivoli, in the town, contains no remains of antiquity.

³ The roof is rounded: it is of cement set on planks laid longitudinally: there is a narrow shelf at the impost (0.10 m. or less).

⁴ For these details see Pacifici, *Atti soc. Tiburt.* v-vi, (1925-6), 59, n. 1.

⁵ Bulgarini (op. cit., 109) informs us that it passed from the Sebastiani family to the Jesuits in 1606; after their suppression, it was sold to Duke Braschi in 1781.

⁶ The villa of the Irish College in Rome was acquired by them in 1842 from the Greek College, for which it was built by Cardinal Salerno early in the eighteenth century.

⁷ At the turn is a modern circular shaft, which may represent an ancient one.



a. ANIO NOVUS: LOOP-LINES IN VALLE D'EMPIGLIONE
(Distant bridge, Tivoli Loop ; nearer bridge, Valle Barberini Loop)



b. ANIO NOVUS: HADRIANIC LOOP IN VALLE D'EMPIGLIONE, CENTRAL
PORTION, EAST SIDE

brickwork, with a tile bonding-course at the spring of the vault. At the inward extremity of this bend the flat top of the exterior of the *specus* has been revealed by a recent trench some 40 m. back from the road.

About 500 m. farther on is one of the most interesting features in the whole course of the aqueduct—a large *castellum*¹ from which the water of the Anio Novus could be supplied to any one of the three lower aqueducts in case of need. An excellent plan of it² (Fig. 31) was made by Cav. Italo Gismondi, to whom my warmest thanks are due. The round-topped *specus*, just before it enters the *castellum*, is 1·27 m. wide, and its intrados was levelled at 247·48 m. The *castellum*³ itself consists of three chambers connected by openings *c, c*, in the centre of each of which are two pillars to carry the quadripartite vaulting of the roof, which runs back to the main walls. The internal buttresses, shown in outline in the plan, only run up to the level of the spring of these vaults, and on the west side there is a continuous shelf at the same level, which also has a flat top; so that by the use of planks it would have been possible to reach any point of the interior by the arched apertures *b, b, b, b* leading easily from one chamber to another (see Fig. 31). At *a* there is a piece of later reinforcement. The west wall is an extremely massive piece of construction, and is further reinforced by a massive concrete foundation *d*, the edge of which lies some metres away.

The *specus*⁴ now continues along the hill-side on the farther side of the *castellum*, dropping no less than 0·43 m. as it emerges. To the right of it, the supply-channel for the other three aqueducts, 0·87 m. wide with a rounded roof, descends far more rapidly, and at 75 m. beyond its exit from the *castellum*, its bottom is at 235·90 m.⁵ Here a short branch *e* led to a vertical shaft, which descended to Aqua Claudia, immediately below (II. 19): and 15 m. farther another descended to Aqua Marcia, the bottom of the channel (*f*) leading to it being at 233·40 m. Both channels are 0·67 m. wide, and that of the Claudia has a rounded end, while Aqua Marcia has two vents, the more northerly being 0·18 m. wide. The Marcia's shaft was completely choked with deposit, preserved in a solid mass. Some 4 m.

¹ Nibby (*Analisi*, i. 27; cf. *Schede*, ii. 50) attributed it to the Aqua Claudia, and Sebastiani (*Viaggio a Tivoli*, 231) to the Villa of Zenobia—quite wrongly.

² The sketch-plan of the cistern alone in *PBSR*. iii. 195 takes no account of the aqueducts, and is therefore worse than useless.

³ It belongs to the original period of construction, together with the descending channel and the downshafts; though the interior appears to have been refaced in the time of Severus, as Dr. Van Deman thinks.

⁴ It can be followed for about 40 m. until the earth from a *puteus* has blocked it. It is of the original construction.

⁵ The fall is 6 m. in 63, or 1 in 10·5, or 9·52%.

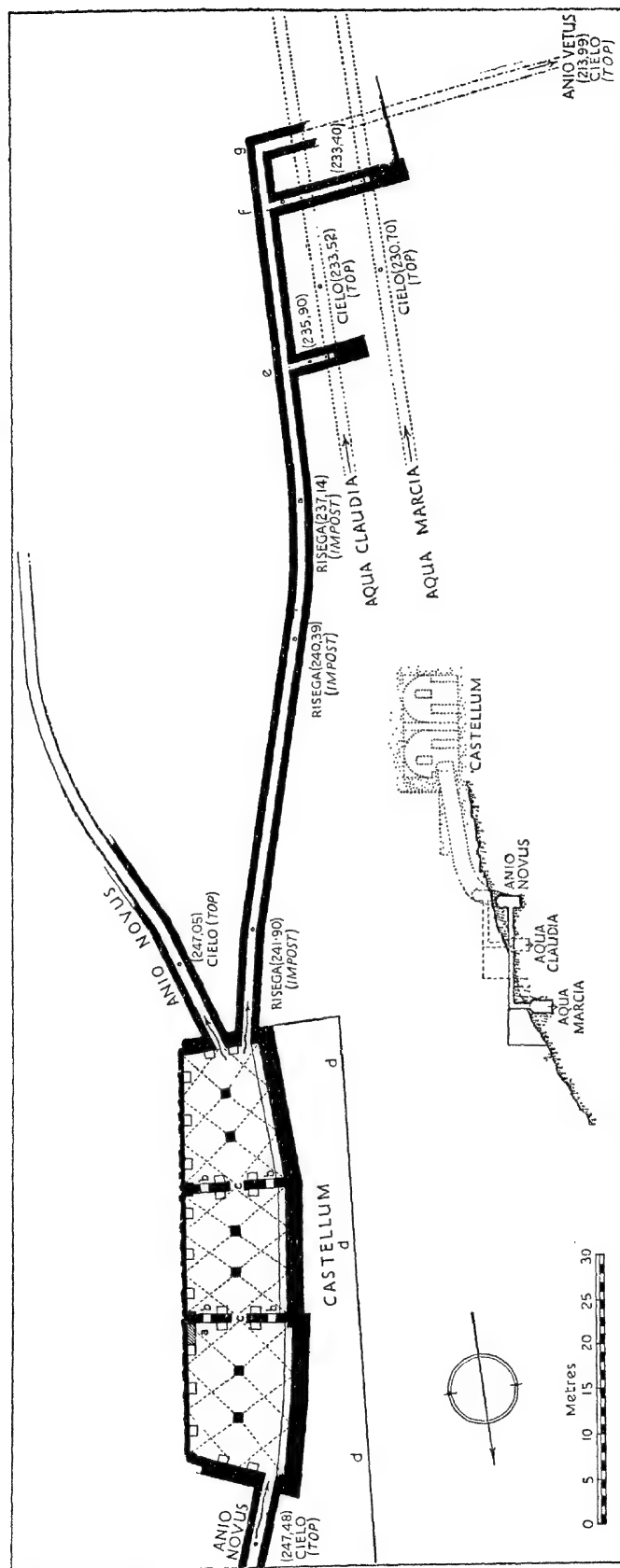


FIG. 31. Castellum of Anio Novus known as Grotte Sconce.

farther on is another channel (*g*), obviously the last of the series, for the supply-channel ends with it. It is built in brickwork, with walls 0.75 m. thick and is no less than 1.1 m. wide, but is soon broken away. There is a brick wall where the shaft must have ended; and from this shaft a channel may be inferred to have descended rapidly to the Anio Vetus, which lies some distance away, below Via di Carciano, where its intrados was levelled at 213.99 m. below the *castellum* (IV. 9).

The main *specus* of the Anio Novus tunnels more deeply than the other aqueducts. It was discovered by the engineers of the modern Acqua Marcia when they constructed the so-called fifth siphon (which is intended for the supply of certain districts in the Campagna); and a scheme, afterwards abandoned, was formed to use its *specus* to convey surplus water from this siphon to Fosso di Gericomio. It was therefore partially cleared from this point to Ponte degli Arcinelli. It was half-full of deposit, which formed a solid mass 0.60 m. deep at the bottom, and only left a channel 0.50 m. wide for the water to pass through.¹ In the whole of this next stretch it had square brick-lined shafts at frequent intervals, which belong to the period of Severus, as does the Ponte degli Arcinelli itself (I. 30).

The bridge, as noted by Lanciani,² is 61.10 m. long and 5.95 m. wide, with two arches, each 5 m. in span, the pier between them being 7 m. thick. The arches are formed of a double ring of tiles; and the intrados has tile ribs, with lighter material between them. At the south end of the bridge, the *specus* is accessible for about 20 m. and here, too, is a late restoration. The direction changes sharply from 40° E. of S. to 40° S. of W.

Beyond the bridge a few more *putei* have been excavated and filled in again. Then the aqueduct is not seen again for nearly a kilometre, but the bank which marks its line along the hill-side can be discerned, with occasional holes into it, though no *puteus* is visible. It reappears high above the road, on the north side of the valley, south of the spur descending from Monte Arcese. Here it is of rough concrete, with a few post-Severan brick courses in the facing, and was no less than 1.60 m. wide with a pointed roof (I. 29),³ but has recently been filled up with earth. On the south side of the valley, the *specus* is seen on the curve, once more round-headed and lined with post-Severan brickwork. Another well-preserved piece has been closed with an iron gate and marked 'Galleria Egidio', after which the channel remains underground for a little way.

¹ These measurements were given me by Sig. Salinari.

² Lanciani, 144 : 356.

³ The point is quite wrongly marked in the map; the valley is just to the south of Villa Maria.

The *specus* is next visible at the extreme easternmost point of the next valley southward, some 80 m. above the substructures of Aqua Claudia. At first a heap of deposit from a *puteus* is seen; then, at the very beginning of the south side of the valley, the channel itself is seen in the bank, faced with late brickwork inside and out; and one buttress is visible. The *specus* wall is 0.90 m. thick, while the extrados is 0.60 m. thick and the vault 0.60 m. high (I. 28). Some few hundred metres south of this valley occurs the first of several groups of *putei*. They begin just above the first piece of the Aqua Claudia, below the road (II. 16). The first is not well preserved, but the second, 12 m. north-west of a small white barn, is in a much better state.¹ Like the rest of the series, it measures 1.25 m. across the line of the aqueduct, and 1.17 m. long, with foot-holes on each side; the outer walls are 0.60 m. thick, faced in late brickwork; and the whole line is probably to be associated with a post-Severan reconstruction of the *specus*. The interval is less than usual, being only about 40 paces or less: and 40 paces to the south again is another, not so well preserved. A fifth was visible in 1914, but has now disappeared. Some 200 m. farther on are two more, about 80 m. apart; the second, among the bushes, is very well preserved, and the depression marking the crown of the *specus* could be clearly traced a few years back.

We now cross a small valley, in which the olive-yards begin once more, and, after some 300 m., comes another group of five *putei*. The first is to be seen on the edge of the olives, a good 100 m. above the road. There are two more under the bank, at the top of an uncultivated patch, and two more farther on again, all at intervals of about 40 paces. After another break a sixth *puteus* occurs, near which the *specus* is accessible in the hill-side; it is faced with late brickwork within and rough concrete without. Below it lies a *puteus*² of Aqua Claudia in *opus reticulatum*. Of the seventh *puteus*, only the upper side against the hill is preserved: the *specus* is accessible on each side of it, and has a pointed roof (I. 27). Forty paces farther on, in the bushes, is another; while the last, which had disappeared in 1928, lay just outside the older olive-yards, beyond a wooden fence.

Another interval, of about 500 m., follows, with no *putei* preserved: then come a group of four more³ similar *putei* in a straight line from west to east, none very well preserved. One of the intervals was measured as 37.80 m. (120 Roman feet). They lie immediately west of the small valley running up from Ponte di

¹ A piece of concrete which has fallen from it lies in the olive-yard below.

² See p. 210.

³ Their position corresponds with the three easternmost marked in the map, but the interval is exaggerated; while the other four should have been marked in the neighbourhood of I. 27, which itself should be rather farther south-east.

Pussiana towards Casale S. Angelo. To the north of them, some 30 paces apart, are two masses of limestone concrete at ground level in the olive-yard, associated by a local informant with the 'condotti di Nerone', but of quite uncertain purpose and date. The *specus* was visible in this valley some years ago, but is now no longer to be seen.

(e) *Fosso di Ponte Terra to Capannelle. Maps 2, 3, 4.*

On the north bank of Fosso di Ponte Terra, some 300 m. above Ponte di Pussiana, is a building which seems to be the reservoir in which the other branch of the Anio Novus, tunnelling under the hills from Valle Barberini, joined that which came by Tivoli. It is a cistern with two chambers, each measuring 10.82 m. long, and 7.15 m. wide, and running from east to west. At the upper end a *specus* 1.22 m. wide, choked with deposit, entered it at about 2 m. from the north-east angle, while the aperture in the dividing-wall,¹ 1.82 m. thick, and that in the exit wall are not quite central either, the latter being 2.47 from the south-west angle, and 3.46 from the south-east. The brickwork of this cistern is certainly not earlier than the Severan period; over each aperture is a relieving arch and there is a lightshaft, 1.20 m. square, in the lower chamber, while there may have been another in the upper, the vaulting having fallen away. The impost of the lowest opening, where the *specus* leaves the reservoir, was levelled at 243.13 (I. 26). About 10 m. below it the slope of the hill begins to be supported by a rough concrete wall, the object of which is uncertain. This cistern is described by Cassio.² There is much deposit on the hill-side between this stream and the one just before Gericomio, but no *putei* are visible; though Cassio says that because of their number the villa of Gericomio was also called Pozzarelli.

South of Casale Gericomio, and north of Colle del Fiore, the small valley of Fosso delle Mandorle runs into the wider Fosso Secco. At the head of it, on the north side, below the path from Gericomio, there is a piece of hill-side *specus*, running south-east by south. The first part is original, faced with rough *opus reticulatum* inside and rectangular blocks of tufa outside. It has a round-headed vault (I. 25). Then follows a piece of late restoration, in concrete which contains much aqueduct-deposit, and is faced with rectangular blocks of tufa. Two buttresses remain, and between them are several vent-holes, 0.18 m. square, sloping down sharply towards the exterior, and lined with deposit from

¹ Above this opening, at the extreme top of the wall under the vault, is a rectangular hole 0.40 m. high, 0.20 m. wide, filled in with concrete at a later date.

² i. 153.

the overflow of the *specus*. Still farther on there is a circular *puteus* faced with *opus reticulatum* inside and roughly laid small blocks of tufa, 2.30 m. in diameter over all. It is to this piece of aqueduct that Cassio's account,¹ quoted by Lanciani,² must refer, according to which it was 2.67 m. high, and 1.56 m. wide. There is, however, no trace of the bridge by which this aqueduct crossed the stream, which below the bridge of the modern path forms a rather deep ravine; nor is there any trace of the aqueduct on the south side of the valley. On the north slope of the hill to the south, to the east of the modern path, there is a quantity of deposit where a *puteus* might have been, though no trace of it is to be seen. The next *puteus*, to the south of the hedge, on the top of the hill, is preserved; it is of concrete faced with original *opus reticulatum*, 2.30 m. in diameter over all, and repaired on one side with rough pieces of tufa. Beyond it there are many fragments of paving-stones in the field wall, possibly from a road following the course of the aqueducts. On the north bank of the small stream to the south a mass of late bad concrete may belong to a *puteus*³ of this aqueduct, for deposit lies about.

The Fosso dell'Acqua Raminga is crossed by Ponte S. Antonio, one of the finest bridges of the Roman aqueducts (Pls. XXIII; XXIV *a, b*, Fig. 32).⁴ It was constructed to carry one aqueduct only, and there is no trace of more than one *specus* anywhere upon it, despite the fact that Canina⁵ and Lanciani⁶ attribute it to the Anio Vetus and the Marcia, and Nibby⁷ to the Claudia and Anio Novus. Petroncelli rightly attributes it to the Anio Novus alone, considering that the bridge downstream belongs to the Claudia (II. 15).

The original bridge was built of ashlar, with abutments of concrete; and owing to the collapse of much of the later concrete by which it was supported, the splendid central arch, 32.30 m. in height, and 10.40 m. in span, is still visible on the west side. It has two prominent oversailing courses, and, farther below, two corbels, probably to take staging for repairs. The upper width of the original bridge was only two stretchers or five headers, i.e. 2.60 m.; its total length is almost 120 m. The two piers on each side of the stream have lateral buttresses, and so has the second on each side beyond them. The height of the courses varies little (from 0.53 to 0.55 m.) but the lengths vary greatly,

¹ i. 14: 'Quello (speco), però, che condottava la Claudia, e l'Aniene nuova, apertosi tre anni sono nel territorio di Castel San Gregorio, o Faustiniaco, in vicinanza del Ponte S. Antonio . . . per essersi misurato in altezza quasi di pal(m) xii, e di vii in larghezza.'

² Lanciani, 137 : 349.

³ It lies too high (250.21 m.) for the aqueduct itself.

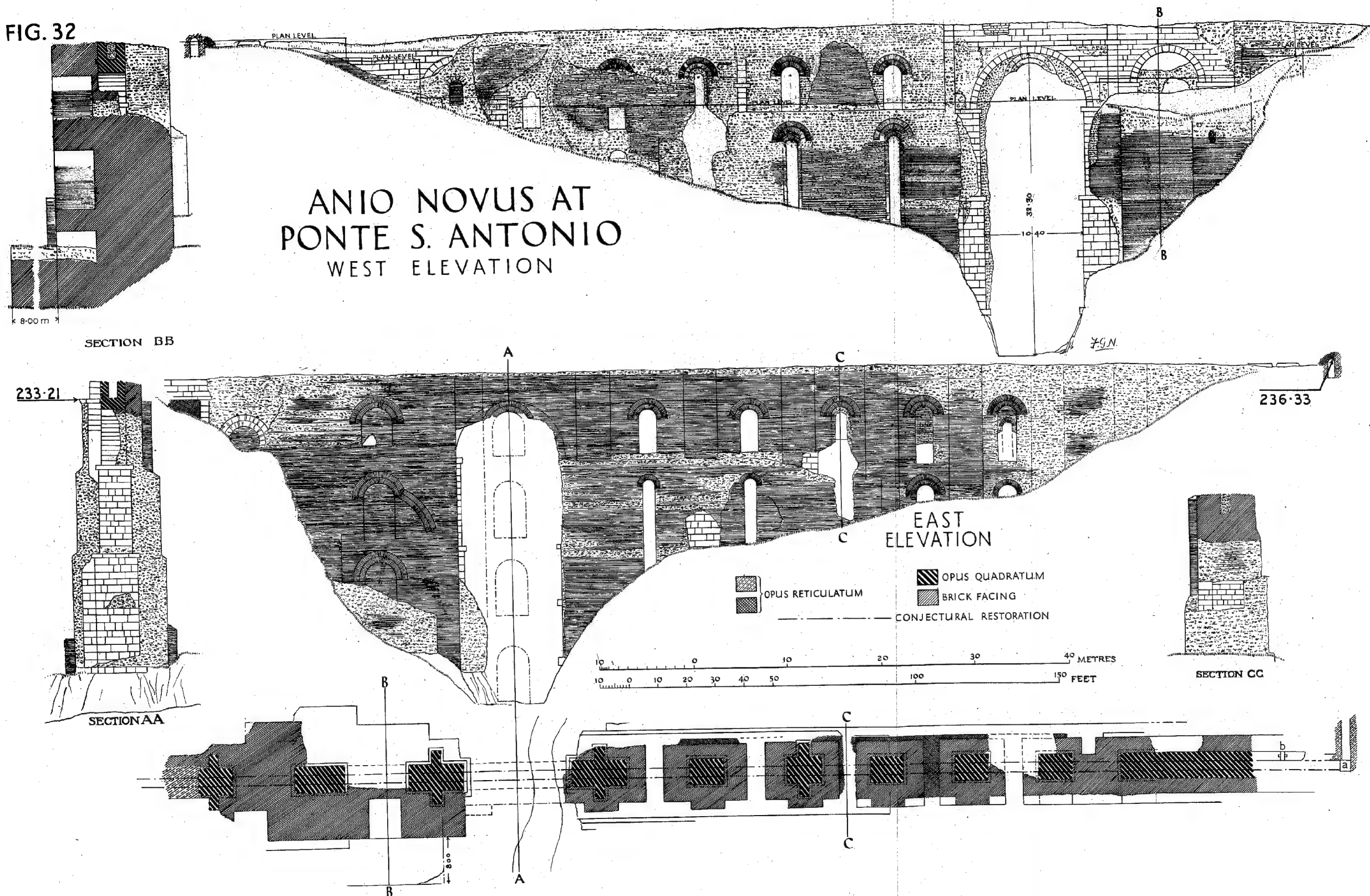
⁴ For a view see Lear, *Illustrated Excursions in Italy*, ii, pl. 14. See also Ashby, *Roman Campagna in Classical Times*, fig. 19.

⁵ vi. 145.

⁶ Lanciani, 79 : 291.

⁷ *Analisi*, i. 33.

ANIO NOVUS AT
PONTE S. ANTONIO
WEST ELEVATION



both in the stretchers and in the headers. I have noted as much as 1.48 m. in the former, and as little as 0.35 m. in the latter.¹ The whole structure was enclosed, in post-Severan times, in brick-faced concrete, with smaller arched openings turned with ladder ribs. In the central arch there may have been four, one above the other, flanked by huge buttresses (see Fig. 32); there were three on the south bank, which were, however, only niches; and two high, narrow arches elsewhere. On the east side, on the south pier at the stream, there is a relieving-arch which has never been completed, one of the usual changes during construction. At the south end the *specus*, still in ashlar, is supported by concrete faced with *opus reticulatum* quoined in tufa, and the same material is used for the *specus* just before it reaches the bridge at the north end. Reinforcements of concrete faced with pieces of aqueduct-deposit were added still later, and in many cases carried round in a thin skin in front of the brickwork. There are also reinforcements at a lower level, as shown on the plan, to protect the foundations on the slope.

The width of the *specus* is 1 m. from the ashlar on the west side to the (later) brick lining on the east, while the height is 3.12 m. from the intrados to the oversailing course in stone which probably marks the bottom (I. 24). There is a characteristic right-angled turn at the west end, with a shaft (*a*) at the turn, the outer wall of which is raised to prevent unauthorized persons from entering. There was apparently a sluice (*b*) on the west side to discharge surplus water; formed by a vent 0.42 m. wide between two blocks, with a slot in each side 0.26 m. long and 0.05 m. wide, which comes down just to the level of the floor of the *specus*; into the slots a small door must have fitted.

The stone blocks are chisel-drafted with bosses projecting 0.11 m., and have very angular joints; the construction is of headers and stretchers irregularly disposed. On the west side of the aqueduct, and north of the first archway leading through it, one of the blocks (0.44 m. high), bears the letters M.V., 0.11 m. high, which seem almost certainly ancient, though their significance is not clear.² During the levelling operations, the writer saw the letters P.R. (0.13 m. high) on the second arch from the north end, the earthquake of 1915 having shaken away some of the late reinforcement on the west side.

The shrine of S. Antonio, from which the bridge took its name,

¹ We may note here that the string course under the *specus* is cut out of blocks, of a total height of 0.70 m., the projecting portion being 0.45 m. high, and the lower part flush with the rest of the ashlar of the bridge.

² Compare the blocks of the Pont du Gard, lettered according to their place in the templet, Espérandieu, *Le pont du Gard*, 46, 48, also Pont St-Maximin, Espérandieu, *Inscr. de la Gaule Narbon.*, no. 405. Ed.

and which is represented by Petroncelli and Lear, has now disappeared. On the south bank of the stream, about 20 m. east of the bridge, is a large round-headed drain cut in the rock, running from south to north; its floor is about 3 m. above the stream-level, and it must be some 0.60 m. wide and 2.00 m. high.

To the south of Fosso dell'Acqua Raminga there is a small ravine, the Fosso Scarpella; and farther south still is another little valley, which runs into the Valle della Mola di S. Gregorio. Both of these bite so little into the main mass of Colle Faustiniano that no aqueduct actually appears in them, a very slight divergence being sufficient to carry all four in tunnels under these depressions. Thus only the deposit thrown out at *putei* appears, though the writer was told of the discovery of other shafts, now filled up. The four aqueducts must here have run so close together, that it would be difficult to assign the shafts correctly without excavation.¹

The Anio Novus crossed Valle della Mola di S. Gregorio farther down-stream than the Claudia, by a bridge which must have been over 40 m. high, the highest² in the whole course of the aqueducts. Some 200 m. down-stream of the bridge the writer saw in 1899 a rectangular shaft measuring 0.90 by 1.70 m. and perhaps 50 feet deep, which may have belonged to the aqueduct; and there is a good deal of deposit.³ Nearer the bridge, on this same bank, a late brick wall may be seen on the edge of the gorge, below the shafts of Aqua Claudia; it is probably a retaining wall, and the *specus* should have been drawn rather farther back in the hill-side than on the plan (Fig. 20).

Nothing is left of the bridge itself on the north-east bank, at the *specus* level, because the cliffs have given way⁴ and the bridge as a whole is even more ruined than that of Aqua Claudia. The original construction may be seen at the base only, in ashlar of limestone (at *i*) and tufa blocks; at *g* there is a tufa block 0.65 m. high, 1.90 m. long, and 0.80 m. thick, where all are especially

¹ Petroncelli (letter of 7 September 1739) describes a shaft in the vineyard of Annibale Giannoni (cf. Revillas, *Vat. Lat.* 9024. 93 v.), which he believed to belong to an aqueduct, but it seems to have been only about 1.10 m. deep from the surface to the top of the channel in which the water ran, so that it cannot have had any connexion with the aqueducts. Possibly the shafts of which we were told were of the same nature. Another *puteus* is mentioned by Cassio (i. 161) as existing on the Colle Faustiniano below the villa which formerly belonged to the Parracciani, and then to the Pace family—apparently towards the Ponte delle Forme Rotte.

² Frontinus' words (15) *hi sunt arcus altissimi, sublevati in quibusdam locis pedes centum novem* may fairly be taken to refer rather to a long line of arches than to an isolated example like this. Canina's reconstruction, with a single arch crossing the stream, is of little value (vi. 146); see our Fig. 20.

³ On each bank of the gorge some way down-stream of the bridge is a rock-cut drain, which has no connexion with this or any other aqueduct.

⁴ Part of the channel 1.20 m. wide appears to have been visible earlier (*Builder*, 142).



a. ANIO NOVUS ABOVE VIA EMPOLITANA, ON THE TIVOLI LOOP,
SOUTH SIDE



b. ANIO NOVUS AT PONTE DEGLI ARCI, TIVOLI

massive. Some fallen blocks may be seen at *b*, while at *i*, where the *specus* reaches the south-west bank of the ravine, there is one block *in situ*¹ belonging to the right-hand side of the *specus*: this is the only trace now left of the original construction at that height and is of tufa, 0.62 m. high and 0.72 m. wide, resting on concrete. The first rebuilding belongs to the Flavian period; to it belongs the concrete faced with *opus reticulatum*, with three bands of brick below, visible at *a*, low down on the right bank and resting on rough concrete foundations in which river pebbles are used, and also at *h*, below the cliff on the left. Considerable repairs in brick-faced concrete were made in the period of Hadrian. For example, it can be clearly seen that the mass *a'* has fallen away from the earlier *opus reticulatum* face² of *a*: fragments *d*, *e*, and *g* have all fallen, but *f* may be *in situ*. At *c* is a mass of rough concrete, of very late date, but *in situ*, though below the bridge line; and other fragments have been washed down-stream beyond the limits of the plan. The mass of concrete adjacent to *h* has been almost entirely covered by a fall of earth.

Immediately after the bridge the *specus* is well preserved. It runs 30° S. of W. for 25.50 m. from *caposaldo* 132: it is cut in the rock, with a rounded concrete roof. It is now in some places choked with deposit. A circular *puteus* (*k*) of *opus reticulatum*, 1 m. in internal diameter, 0.70 m. before a turn, which Petroncelli mentions in a letter of 5 April 1740, and which I saw in 1899, has since been filled up; the crown of the vault was only some 0.90 m. below the ground-level. Near this *puteus* is the fragment of a *cippus*, 0.50 m. high (not including the rough part below ground) 0.24 m. wide and 0.19 m. thick; and rather farther on is another, a block of tufa 0.88 m. high and 0.30 m. thick, with no traces of an inscription.³ After the *puteus* the channel turned 5° E. of S. and ran in this direction for 38.50 m. and then turned 20° E. of S. again. It probably continued in this direction, and must have come just above ground-level, until it reached the north-east branch of Fosso dell'Inferno, which it crossed almost due south by a single-arched bridge of ashlar, strengthened at a later period with brickwork.

A fairly good drawing of this bridge is given by Canina.⁴ The ashlar arch was 3.80 m. wide at the base, the width gradually decreasing to 3.20 m. at the arch itself. The pier and the spring of the arch on the right bank are alone preserved, the rest having

¹ Upon it *caposaldo* 132 (228.70 m.) was taken, which would be rather below the impost.

² After a certain height this earlier face was removed so as to allow *a'* to attach itself more closely to *a*, in spite of which they have split. The ashlar blocks at the base of *a'* are 0.52 and 0.60 m. high: under them is a tile-course and concrete below that again.

³ As far as we know the *cippi* of this aqueduct were invariably uninscribed.

⁴ v. 150, vi. 146; in his text 'Aniene vecchia' is an obvious misprint for 'nuova'.

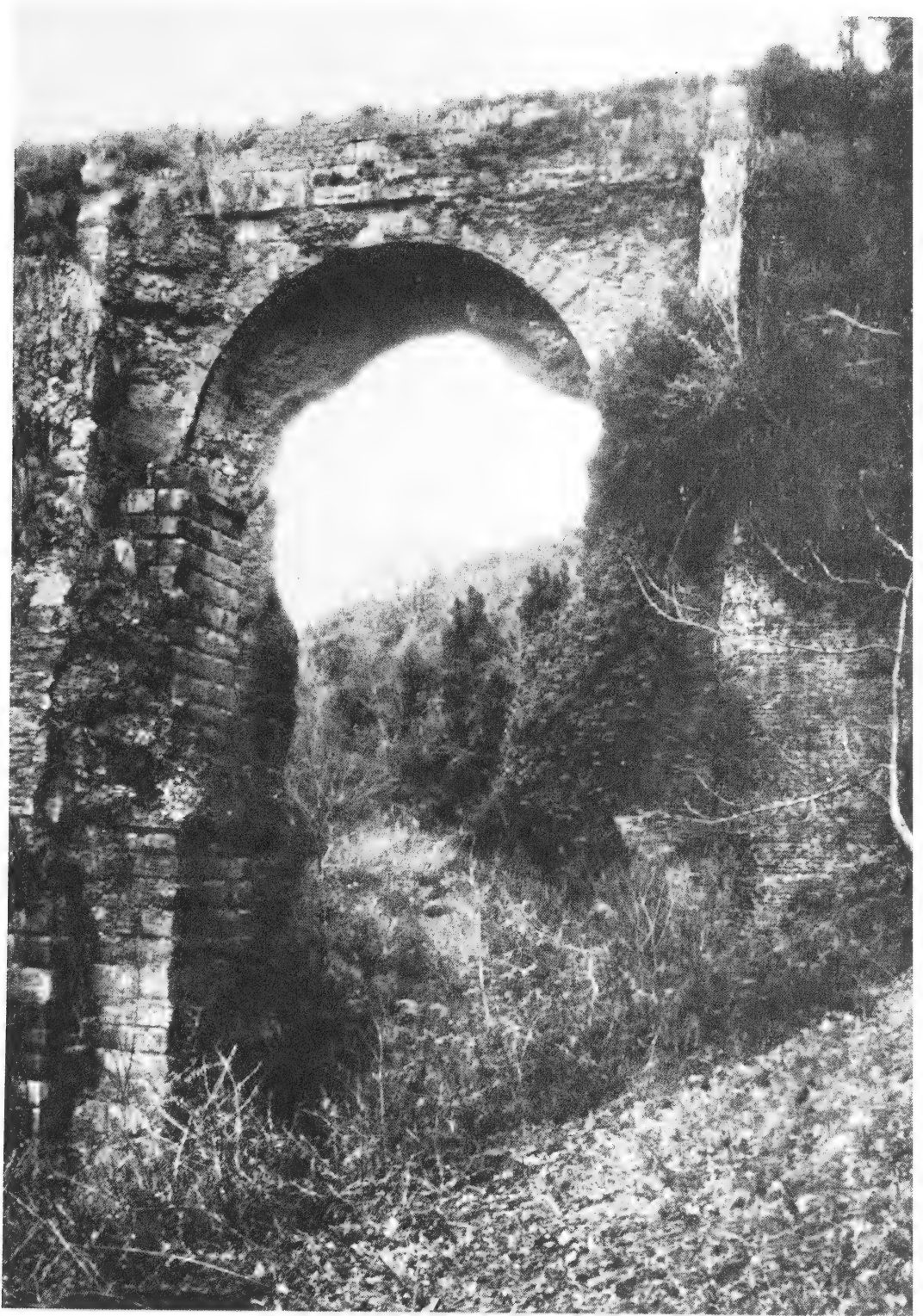
entirely collapsed. The *specus* was originally built in ashlar of local porous limestone, from a bed which lies immediately above the tufa on which the bridge rests; but it was partially renewed in brickwork at a late period, probably the fourth century. The east wall of this restoration is alone preserved, and still hangs over the stream despite the collapse of the ashlar below, a testimony, as Canina says, to the strength of the concrete. It was supported externally by small brick pilasters. When the vault was restored, the external wall¹ was set back about 0.35 m. from the face of the brick wall of the *specus*. The deposit is very foul, clearly belonging to the Anio Novus.

At the end of the small west branch of the stream the *specus* (I. 21) of the Anio Novus, in the left bank, carries the spring which supplies it. It has been roughly hewn through the rock, and lined with concrete 0.50 m. thick. The round-headed roof is of rough original concrete, and the width of the channel is 1.06 m.; it runs 10° E. of S., and is soon blocked by earth, so that it cannot be followed. A hundred metres to the south, at the edge of the path descending from the high road, is a *puteus*, lined with *opus reticulatum* of tufa, 1.30 m. square inside: the direction of the aqueduct is 20° W. of S. Some 200 yards to the south-east of the end of the *specus* is the deep-lying bed (often dry even in winter) of another stream coming from the upper part of the same small valley. This stream has been carefully diverted in Roman times, in order, no doubt, that the aqueduct might not suffer damage; it runs away, some 20 m. below present ground-level, in a tunnel 0.80 m. wide and about 3 m. high, cut in the rock, which probably had a shaft or sluice at the entrance as there are traces of Claudian concrete.² The tunnel descends steeply in a south-west direction, and probably took the water off into the valley north of Casale S. Giovanni in Campo Orazio.

From the results of levelling it is perfectly clear that the Ponte Lupo had nothing to do with either the Claudia or Anio Novus. I have searched the valley of the Fosso dell'Acqua Rossa (called Valle dei Morti near Casale S. Giovanni) for a sufficient distance above the Ponte Lupo to exclude the possibility of either of them having appeared above ground; and it must therefore be supposed that they passed under this valley by a long tunnel, which gives them a far more direct course. A circular *puteus*, probably better assigned to the Anio Novus than to the Claudia, is situated south by west of Casale S. Giovanni, near the edge of the deep southern branch of the Valle dei Morti. It is 1.20 m. in diameter, lined with roughly faced concrete, and is now open only to a

¹ The brickwork is discussed by Dr. Van Deman.

² Dated by Dr. Van Deman.



ANIO NOVUS: PONTE S. ANTONIO, FROM THE WEST

depth of 5.50 m.¹ Some way 25° S. of W. there is another, and deposit is plentiful near both of them.² A third shaft may be seen to the south-west of the last, in a vineyard; it has been cleared to a depth of a little over 20 m. and lined with modern masonry, and is now rectangular. But, since the writer was told that the channel at the bottom did not run towards the last shaft seen but in a northerly direction towards the stream, it was probably connected with a drain, and not with the aqueduct at all. Certainly the Anio Novus must at this point have been running at a depth of about 50 m. (see I. 21), for the ground-level is about 275 m.

Some interesting considerations in regard to the length and level of this tunnel have been elicited³ by levelling. The difference in level between Ponte dell'Inferno (I. 21) and Ponte Scalino (I. 20) is about 26.37 m. and the distance about 2,500 m. in a straight line. This would give a uniform fall of 10.55 ‰,⁴ though there may have been steps at the shafts. Supposing the *specus* to have been 1.20 m. wide and the average depth of the water 0.50 m., according to Bazin's formula⁵ the velocity may be determined at 3.55 m. per second. In the next tunnel, from Ponte Scalino to Ponte Amato (I. 19), which was 675 m. long, the velocity would have been 4.42 m. per second. In the third, as far as the Fienile, which lies between I. 18 and I. 17, 4.08 m. per second. In the middle stretch no shafts have been found: and in all three cases the rather exceptional speed may well have been adopted to prevent the excessive formation of deposit.

Going towards Gallicano two modern shafts, south-west of Casale Sabelli, communicate with a rock-cut channel, some 1.40 m. wide, by which the fountain to the north of the village is supplied. This channel is certainly not the *specus* of an ancient aqueduct; but a good deal of deposit may be seen in the channel, and more has been built into the shafts, so that the aqueduct must have passed close by. It is indeed not impossible that it came above the surface in the little valley on the north side of Gallicano, for the level of the water in the stream under the modern road-bridge here is only 202.89 m.: but there is no trace of any aqueduct to be seen or reported, though Fabretti marks a bridge.⁶

It has been assumed that the first road-bridge beyond Gallicano

¹ A circular shaft 300 paces to the north-west, cut in the rock, about 1 m. in diameter and 5.20 m. deep, is probably not connected with either aqueduct, as no deposit is to be seen anywhere about. There was said to be yet another in the *macchia* (brushwood) below, which is not now to be found.

² Only one is marked in the map.

³ *Livellazione*, 70.

⁴ In the section these figures vary slightly (26.20, 24.50, 10.7).

⁵ Velocity = $\chi\sqrt{r}$: now $\chi = \frac{87}{1+\gamma/\sqrt{r}}$, γ being the coefficient of the smoothness of the sides, estimated at 0.16, and r the mean section of the stream; thus $\chi = 78$.

⁶ In the map belonging to his *Iasitheï ad Grunnovium apologema*, see p. 3, n. 3.

and the Ponte Amato carried both Aqua Claudia and Anio Novus, and these have been described elsewhere.¹ It is certain that at least the second bridge² carried both aqueducts; for, in the deep cutting of Cavamonte, immediately to the south-west,³ two *putei* of the Anio Novus exist. The first is situated⁴ at the north-east end of the cutting, on the south-east side of the road: it is of late concrete, about 1 m. square inside. It is faced with rough stones and mortar outside⁵ and with rough pieces of stone on the inside; from its orientation the aqueduct below it should have been running 15° N. of W., while the bridge runs south of west; but such a turn after a bridge is not uncommon. The other two are situated farther south-west, within 6 m. of each other, and are both orientated 30° W. of S.; that on the north-west side of the road belongs to the Claudia, and is described with it; that on the south-east side measures 1.40 m. by 1.50 m. inside, and its concrete walls, faced with *opus mixtum*, are 0.60 m. thick. It lies on the bank some way above the road (from which its interior may in part be seen), and is supported by two buttresses and a piece of curtain wall, also faced with *opus mixtum*.

After emerging from Cavamonte cutting, and crossing the road which leads from Zagarolo to Ponte Lucano on Via Tiburtina,⁶ there appears to the south of Via Praenestina a line of substructures,⁷ about 230 m. long, running WSW. and belonging to the Anio Novus. At first the facing is of the very worst possible quality, of medium-size rectangular blocks of stone, laid with mortar; and there are remains of a definitely post-classical building, perhaps a small house of quite recent date, on the top. Then comes facing in *opus mixtum*, reinforced with buttresses at intervals of from 1.55 m. (reduced in one place by an extra reinforcing wall to 1.02 m.) to 1.80 m.: the buttresses themselves project from 1.02 to 1.50 m., and their fronts vary in width from 1.65 to 2.38 m. At the point where a tiny stream passes through the aqueduct,⁸ a part of the original construction is visible, an arch

¹ See p. 215.

² Ashby, *Roman Campagna in Classical Times*, fig. 20.

³ The first *puteus* is omitted in *Builder*, 143.

⁴ The cutting was originally made for the Via Praenestina, some of the paving of which is still preserved under the little chapel of S. Maria di Cavamonte. See *PBSR.* i. 207, where only one *puteus* is mentioned, and where it is wrongly stated that Nibby, *Analisi*, i. 444 attributed the ashlar in the crevice of the north-west side of the cutting to an aqueduct; whereas he speaks of it as intended to prevent excess of rainwater in the cutting.

⁵ So was perhaps underground.

⁶ *PBSR.* i. 205 ff.; iii. 140.

⁷ Their existence is roughly indicated by Fabretti in the map of the *Apologema*: and they are shown in Cingolani's map, and also by Nibby (*Analisi*, i. 473), by whom they are wrongly attributed to the Claudia. For the construction, see Dr. Van Deman's detailed discussion.

⁸ The present track passes over the same stream on a bank of water deposit, through which a tunnel has been cut for the passage of the stream; so that the leakage must have been extensive enough to provide all this material for making of the road, a method which

in ashlar, in great part filled up with earth, which must have served for the passage of the stream in Roman times. The arch was only 2.60 m. wide, but its span cannot be ascertained; the tufa voussoirs have holes for swallow-tail clamps in pairs at the ends, in one of which some traces of the cement key remain. They also have a dowel hole in the centre of the lower edge to attach them to the next voussoir sideways. All traces of the original *specus* have disappeared, and the present one marks a late restoration. It is 1.32 m. wide, with walls of coarse concrete faced with brickwork both inside and out, of the late third or early fourth century. The *specus* wall on the north is 0.70 m. thick at the top, and 1.44 m. lower down, where it has an external cornice; on the south, it has been rebuilt to 1.44 m. thick. *Caposaldo* 100 was placed on a tufa block of the *opus mixtum* facing, not far off the level of the impost (I. 18). The deposit was 0.30 m. thick.

Further additions, however, became necessary. On the north there is a concrete external reinforcement, 1.35 m. thick, faced with still later brickwork; and beyond it occurs a buttress, 0.97 m. thick, faced with very bad *opus mixtum*, which is later again; while on the south-east there is a concrete buttress no less than 3.10 m. wide, also faced with very bad *opus mixtum*, placed to regulate the stream. The total width was thus increased to no less than 9.60 m.

The Fienile is a modern building, with a stable in the lower floor: between it and the first out-buildings the *specus*, 1.26 m. wide, is visible. Beyond the last outbuildings, there can be seen a section of the aqueduct in good concrete, faced in fine Hadrianic brickwork, with buttresses on the lower (south) side, the first being 1.45 m. wide, with a projection of 1.20 m. Close by, at an almost right-angled turn, is a much larger buttress,¹ followed by a *puteus* 0.93 m. long, the *specus* being still 1.30 m. wide with a pointed roof 1 m. high. The next buttress, 3.40 m. away, is 1.45 m. wide with a projection of 1.90 m., and the next interval is 4 m. We now reach a path leading SSW., where *caposaldo* 99 was placed on the tile offset 0.15 m. wide, from which the pointed roof of the *specus* starts (I. 17). This portion of the aqueduct was especially interesting, as on the north-west side of the path the original *specus* wall,² of concrete faced with *opus reticulatum*, was visible. This was only seen on the exterior, which was accessible by a hole made in recent times; and it was only preserved to 0.40 below the impost, above which brick-faced

it is very doubtful whether the Romans would have adopted for the repair of the Via Praenestina.

¹ *Livellazione*, p. 36 unit.

² The wall is divided into two vertically, one 1.40 m., the other 0.57 m. thick, as Dr. Van Deman pointed out to the author.

concrete of the Hadrianic period began, covering the left-hand *specus* wall completely. The *specus* has now been closed. Its extrados is practically level with the path, which here turns SSW.; and if an ancient road diverged here, as the widened pavement of Via Praenestina certainly appears to indicate,¹ it must have passed just over the top of the *specus*, a proceeding by no means impossible if the traffic was not very weighty, and actually adopted where the important Via Aurelia crossed Aqua Traiana.

A rectangular *puteus* is soon reached, at a distance (edge to edge) of only 20.66 m. from the last. Adding 0.92 for the length of the *puteus*, the measurement from centre to centre is 21.58 m., or just over 70 Roman feet; and this, with other examples quoted above, will be sufficient to dispose of any idea that the *putei* were at regular intervals, or had any connexion with the *cippi*. The exterior is visible in the vineyard above: it measures 1.88 by 2.06 m. over all, and is of very late, bad work. Beyond the *puteus* the rock cutting continues, and the aqueduct soon disappears under the rising ground. As indicated in the map, it must turn again almost at right angles, in order to have as short a tunnel as possible under the higher part of the hill, and to return to its previous direction.

The so-called Ponte Diruto (named Ponte Barucelli on the map) consists of two bridges close together, one of the Anio Novus and the other of Aqua Claudia (see Fig. 21). The upper, or southern, bridge, belonging to the Anio Novus, is 83.95 m. in total length. The original work was in ashlar, as is clear from the existence (at *a*) of two or three voussoirs of an arch in this material. In the Flavian period² the bridge was rebuilt in *opus reticulatum* with brick bands. At *e* there are two buttresses of this period. These were re-fronted in the Severan period, but only below the projecting tile course. There was a general strengthening, as shown in the elevation, with concrete faced with good Severan brickwork. At one point on the west bank the new face replaces the original *opus reticulatum*. Buttresses were placed at irregular intervals all along the north side; on the south, it seems, they were considered unnecessary. Later on, the south side was reinforced twice, first with a wall of bad brickwork,³ in two periods, strengthened by five buttresses; secondly, by two buttresses of *opus mixtum*, over which deposit has flowed, on the east side of the stream. The stream here passes through a small aperture, floored in concrete, in which it drops about 4 m., being held up

¹ *PBSR.* i. 204.

² Dr. Van Deman's dating has been adopted, as usual, throughout.

³ One of the bricks of the cornice of the earlier reinforcing brick wall (which consists of three courses of tiles carried round into the buttresses) 0.04 m. thick, bears a rectangular stamp of which I could only read the letters O A N.

above the bridge. We may observe the three corbel blocks of tufa on each side to take a staging for repairs. There are also some late arches connecting this aqueduct with the Claudia (*d, d, d*), traceable only at their springing. A hole, 0.60 m. square (at *c*), no doubt was intended as an overflow, but is now filled with aqueduct deposit. The *specus* (section B B) has a rounded roof and walls 0.93 m. thick, with a very foul deposit. The level taken on the deposit on the bottom of the west end was 178.04 m., and that of the intrados 179.99 m. (I. 16); but if the *specus* is at all comparable in height to that of the Claudia (3.62 m.) the actual bottom level must be over 1.50 m. lower. In any case, the Claudia is here the higher of the two. There is a very deep shaft above the west end of the bridge; its sides are unfaced, and it is not certain whether it was round or square.

After Ponte Diruto, the Anio Novus remains underground for nearly a mile. A *cippus* belonging to it is to be seen on the hill to the west (see map). In the west branch of Fosso dell'Acqua Nera, 100 m. above the *puteus* of the Claudia, there are large quantities of deposit on the west bank, suggestive of a *puteus*. The aqueduct passed under the stream south of the Fontanile di S. Isidoro; and there is deposit about 100 m. or more above the communal boundary marked in the map, but no trace of construction. The aqueduct finally reappears in the east branch of Fosso di Biserano, 150 m. farther up-stream than the two bridges, which are attributed to Aquae Marcia and Claudia respectively.

The bridge was originally built in ashlar, with an arch over the stream of 4.70 m. in span; and there was at first another stone arch on the east bank, the spring of which can be seen on the south side, with later brickwork in the spandrel and a brick relieving arch above the ashlar one. The arch has fallen, though filled with *opus reticulatum*, but the string-course above it still adheres to the concrete; everything above this is of later date. The bridge was originally only 2.70 m. wide: it was first reinforced in the Flavian or Hadrianic period, with concrete 0.90 m. thick, faced with *opus reticulatum* and ashlar at the stream-level. The Severan restorers applied yet another concrete wall 0.62 m. thick, faced with brickwork. These reinforcements are only visible on the north side, down-stream; the second had two projecting corbels at the spring of the brick arch. The width of the bridge below was thus increased by 4.22 m. and this carried the present *specus* of concrete faced with Severan brickwork, the side walls being 1.15 m. thick. It is roofed with two large tiles, inclined towards one another, resting on the side walls; from the intrados to the deposit on the bottom the height of the

specus is 3.07 m. The total width of the bridge¹ at the base is 10.40 m.²

At each end of the bridge the *specus* (I. 15) can be seen going into the rock; here it is round-topped and 1.18 m. broad; the direction is ENE. and WSW. At the east end there is an outlet to the right, 1.10 m. wide, flanked by two vertical slots; these must have held a sluice-gate for discharging water during repairs to the bridge. At the opposite end are traces of a rectangular *puteus* cut in the rock, with steps leading down to it; in this also there was a sluice, leading left.

There is no trace of the Anio Novus in the shallow west branch of Fosso di Biserano; but there is some deposit in a straight line 20° S. of W. of the bridge just described, to the north of the point marked 211, a kilometre north of the top of Monte Massimo; and there are traces of several *putei* (one indicated in the map) which lead us on straight to the crossing of Fosso della Vetrice, or di Pallavicina, about a kilometre ESE. of Casale della Pallavicina. Here the *specus* is accessible; it has a pointed roof (the cement lining is gone) and the original brickwork is preserved for a height of about 2 feet from the floor on the east side of the stream (I. 14): on the west side it has been restored and converted to modern uses.³ Two modern shafts (still in the same direction, 20° S. of W.) were found to be 116 paces (about 270 feet) apart, but may be converted from old *putei*. Farther west there is a modern well, now dry, some 50 feet deep, in which construction much aqueduct deposit and some *reticulatum* cubes have been used. Similar traces are found at the point where the aqueduct crossed the little Valle Marchetta,⁴ to the east of the Quarto della Colonna, where two modernized *putei* may be seen which no doubt belong to it.

The Anio Novus now seems to have run SSW. There is a quantity of deposit attributable to it; and a shaft found about 1900, at some 300 m. east of Fontanile di Valle Ginestra (in the earlier editions of the map, Valcanestra) may have been connected with it. It was described to the writer as a *puteus* about 2 feet round with a large block about 1 m. high by 0.50 m. wide placed on one side of it; but there were no traces of deposit, and the

¹ Further reinforcements below are (a) a brick buttress on each side down-stream 4.60 m. wide, the arch of which, mostly fallen, rested on the corbels already mentioned; (b) a wall (visible only on the west side; on the east there is nothing but concrete, up-stream) of rough blocks of ashlar badly laid, with the interstices filled with concrete: the length on the west is 6.25 m. One of the blocks measures 2.17 m. long by 0.88 m. high, and 0.75 m. thick.

² *Builder*, 174.

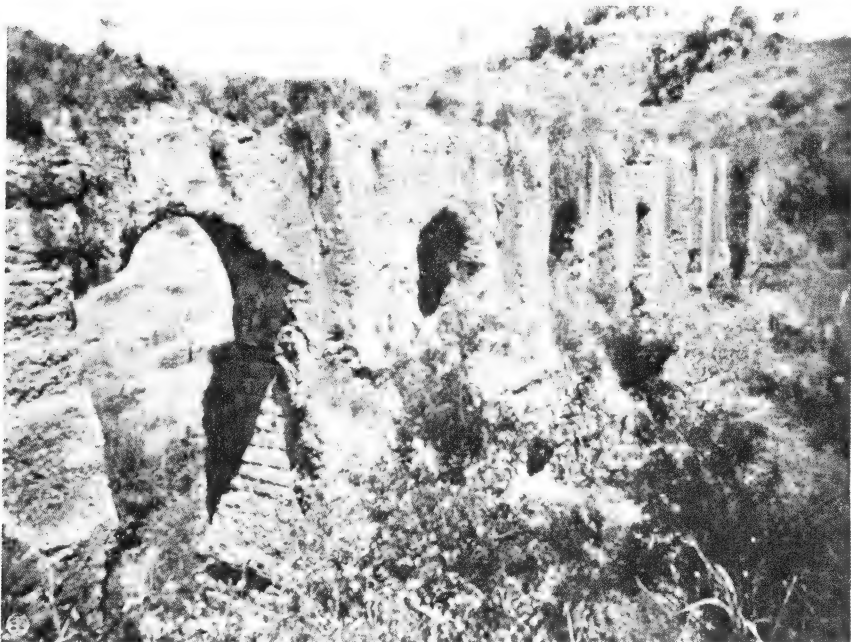
³ It was probably used as a branch of the Acqua Felice.

⁴ On the west edge of this valley about 600 m. south of the Casale, I saw in November 1903 a *specus* running 20° W. of N. built of *selce* concrete faced with *opus reticulatum*; but at the end of 1914 it was not to be found, and had no doubt been filled up. It is not marked in the map, in which the line of the Anio Novus is shown a little farther north: and I do not know to what it can belong.

PLATE XXIV



a. ANIO NOVUS: PONTE S. ANTONIO, FROM
THE EAST



b. ANIO NOVUS: PONTE S. ANTONIO, LOOKING NORTH-EAST

finding of a lead pipe may indicate rather that there was a villa here. Next follows a bridge in original *selce* concrete over the small valley which descends just west of Casale delle Marmorelle. This lies close above that of the Claudia, but is almost entirely destroyed.¹ There is much deposit in the field wall to the west, as if a *puteus* had been there.

In the next valley westwards, on the west of Colle della Lite, in the vineyards belonging to Casale Mattia, and NNW. of Monte Compatri railway-station, there are considerable remains of a substructure in concrete faced with *opus reticulatum* of *selce* with *selce* quoins; on the north side are six buttresses, four on the east side and two on the west side of the stream, and there may have been more to the east; the south side is hidden by an accumulation of earth. The *specus* is about 2 m. high, excluding the vault, and the side-wall is 0.90 m. thick. The interval between the buttresses is about 4.95 m.; they are 1.50 m. wide, except for that nearest the stream which is 1.80 m. wide, and they project 2.35 m. They are faced in small rectangular blocks of *selce*. The use of *selce* points to original construction,² and there is no trace of alteration or restoration. The exterior of the aqueduct is here faced with hydraulic cement in places, a practice by no means universal. Such cement would, indeed, have been necessary only on the external walls of the *specus*, and perhaps that is the reason why it does not appear in the loftier bridges, where exposure may have led to its destruction.

The deposit in the Regione Forma Rotta has already been mentioned in speaking of the Claudia.³ The *specus* of the Anio Novus is seen in Valle della Forma Rotta, in the stream, and is 1.20 m. wide.⁴ On Colle Trugli are two circular *putei*, 80 m. apart, giving the line of the aqueduct as 15° W. of N. at this point, though it soon turns west. The westernmost is 1.10 m. in diameter without the lining. As noted above, there is abundance of deposit from this point to Prata Porci; and three *putei* are tentatively shown on the map.

The stream which traverses this basin was crossed by the Anio Novus on a single-arched bridge some 6 m. in span, about 40 m. south of that of the Claudia, and 2 to 3 m. higher, so that the top of it is just about at ground-level (145 m.). On the east bank the concrete side walls, 0.85 m. in thickness, are faced with Hadrianic brickwork, inside and out. Below, there is an original

¹ In *Livellazione* p. 30, it is listed as I. 13 (*caposaldo* 80); but the level must have been taken on the bridge of the Claudia, for there is no path across that of the Anio Novus.

² See Dr. Van Deman's detailed treatment of materials and their dated use.

³ See p. 220.

⁴ This point was not included in Ing. Corbellini's levelling operations: but the bottom of the *specus* must be about 147 m. above sea-level.

opus reticulatum wall, 2.85 m. wide, reinforced by brick walls 2 m. thick on each side,¹ and buttresses of the same material on the west bank. Brick walls 0.60 m. thick have been added later, on each side. The direction is 13° S. of W. On the south side there are two offsets in the original brickwork, of which the upper very likely corresponds in level with the bottom of the *specus* (I. 11). The deposit traceable to the west of this bridge belongs in part to the Claudia and in part to the Anio Novus, which must have crossed the Claudia here² and passed on its north side; for at some 30 m. north of the *specus* of the Claudia in the Valle della Morte, the original concrete *specus* with curved intrados has recently been discovered in a vineyard, just to the west of a modern path (I. 10). The size of the channel has been reduced by the accumulation of deposit to 0.80 by 0.40 m.,³ representing here, as elsewhere, the aqueducts in their last stage of use.

The Valle della Morte, here quite a small stream, was then crossed by a little bridge in concrete, running south-west, faced with Claudian *opus reticulatum* quoined in tufa. The *specus* is 1.10 m. wide, with side-walls 0.85 m. thick; and it has been reinforced, as an afterthought, on the south-east by a wall of *opus reticulatum* 0.75 m. thick, with a buttress 0.90 m. thick, faced with small rectangular blocks of tufa. On the south-west bank a distribution-chamber immediately north-west of the aqueduct was found in the spring of 1914. A lead pipe with an external diameter of 0.14 m. and bore of 0.10 m. led into a small tank, 0.60 by 0.90 m., with walls 0.15 m. thick; and at the opposite end there were no doubt other pipes (which we were told had been found). Like the aqueduct, it was built of *opus reticulatum*, in cubes 0.075 m. square. The pipe bore the inscription: AVRELIVS . . . | EPISTVL LAT DIGITI . . . : and over the D of the second line was the bottom of an E or an L. There is practically no doubt that the complete inscription would have run, as on a lead pipe found at Gabii⁴ in 1792, *Aurelius Alexander prox(imus) ab epistul(is) Lat(inis); Digi(n)us fecit*. Aurelius Alexander, who was Second Imperial Secretary in Latin, must thus have owned an estate here as well as at Gabii.⁵ The floor of the cistern (*caposaldo* 62) was 136.16 m. above sea-level, or 14 cm. higher than *caposaldo* 65.

The *puteus* in the next hill to the north-west, NNE. of Fontanile Trasanella, probably belongs to this aqueduct. It is circular, faced with *opus reticulatum* outside, and with later work inside; it is 1.33 m. in internal diameter and its walls are 0.45 m.

¹ The extreme width of the foundations is 5.10 m. For further details see Dr. Van Deman's work.

² Not at the Fontanile Trasanella: the map is wrong (*supra*, p. 220, n. 6).

³ *Livellazione*, fig. 15.

⁴ *CIL.* xv. 7832.

⁵ *PBSR.* i. 186.

thick. About 70 m. south-west by south of it, and north of the Fontanile, a piece of the original channel can be seen crossing the valley.¹ The *specus* is 1.30 m. in width without the cement lining, at the bottom, increasing to 1.60 m. higher up, with a pointed roof; and the side-walls are 0.77 m. in thickness, of concrete unfaced inside and faced outside with *opus reticulatum* quoined in stone and bonded with a double course of short bricks. The direction is 35° S. of W. On the south-west bank is a buttress, and it is probable that originally no stream passed here. The bottom of the *specus* on the right of the stream is at 135.90 (I. 9); *caposaldo* 61 is at 136.15 m. upon a stratum of deposit 0.25 m. thick, and the intrados on the left is 138.68 m. (*caposaldo* 60 is 0.05 m. above it = 138.73 m.). Corbellini noted another piece on the right bank, in May 1914, which was soon afterwards destroyed.

The aqueduct then tunnelled through the hill which forms the north-east wall of the small extinct crater of Pantano Secco.² Large quantities of its deposit, and fragments of mortared *selce* from its *putei*, are to be seen on the south-east side of this basin, at about 140 m. above sea-level, so that the aqueduct would be running only a little way below ground.

In the valley of the main east branch of Fosso del Cavaliere, on the west bank of the stream close to the path, are traces of a *puteus*, which must have been faced with *opus reticulatum* of *selce*.³ It then passed under the north edge of Macchia della Sterpara, where there is much deposit; while much also exists in the smaller west branch of Fosso del Cavaliere, and in the vineyard WSW. of the Macchia. After passing under Via Cavona, the top of the concrete vault of the channel appears in the bank which forms the boundary of the vineyard, and also along the hill-side a little farther on.⁴ A heap of deposit, taken to mark a *puteus*, lies at the point where the aqueduct passes under the track from Fontanile Vermicino to Tenuta di Torre Nova.

The ground then drops considerably, by 15 to 18 m., and as neither aqueduct appears above ground, a considerable drop in the level of their channels must be assumed. The presence of enormous quantities of deposit on the hill east of the thirteenth kilometre of Via Tuscolana,⁵ may indicate the existence of

¹ *Builder*, 204.

² *PBSR*. v. 321.

³ For the attribution of it to the Anio Novus, and of the bridge (I. 8) to the Claudia, see *supra*, p. 221, n. 6.

⁴ On 11 April 1900, when a good deal more was visible, I noted the *specus* as being about 1.20 m. wide, the whole of the west side, with the deposit on the bottom and the foundations, being visible.

⁵ It was far more noticeable twenty or thirty years ago, when the ground was still untouched by cultivation.

subterranean clearing-tanks, in which the water fell by steps some 10 or 15 m. For the normal fall, if we allow $4\frac{1}{2}$ kilometres instead of two between *capisaldi* 50 and 43, would be¹ only 7.24 m. whereas 21.37 m. have to be explained.

On the hill north of point 112 three round *putei*,² at intervals of 74.40 and 76.70 m. respectively, that is, 249 and 256 Roman feet, were visible before the ground came under cultivation, in a line descending WSW. towards the next stream. They were built of rough concrete, and their internal diameter was 1.05 to 1.09 m. By the stream there is a wall in *opus reticulatum*, which may be connected with another *puteus*, for the distance from the last is just about double the normal interval of 240 Roman feet.

The aqueduct comes to light again on the next hill, to the north of the great villa at Centroni.³ Its concrete *specus* is visible at the ground level; and it was brought to light in the valley below for a length of about 300 m.; it was 0.90 m. in width and about 2 m. high; the side-walls, with rough facing inside and *opus reticulatum* outside were 0.89 m. thick, and were plastered both inside and out with cement 0.03 m. thick, probably to prevent leakage. At intervals of 2.40 m. there were buttresses⁴ 1.80 m. wide projecting 1.50 m.

The aqueduct can then be seen entering the hill-side under a new farm-house;⁵ here the *specus* has a semicircular vault in rough concrete, the extrados of which is 1.10 m. thick and is protected by a flat layer of cement. The vault is 0.30 m. high inside, and the *specus*, 0.90 m. farther down, begins to be narrowed by very foul deposit to about half its normal width; a total height⁶ of 2.40 m. has been assumed. *Caposaldo* 43 was taken on a brick 0.18 m. above the intrados, which puts the latter at 99.38 m. and the bottom at 96.98 m. or 2.51 m. lower than the Aqua Claudia, which is, however, falling so rapidly that there would just be room for the two to cross.

In 1902-3, a *specus* was to be seen in the field to the south-west, at a level slightly below Via Latina, running south of and parallel to the Marrana Mariana; this was almost undoubtedly the Anio Novus, but the writer could not then obtain its precise level;⁷ and on a second visit the hole had been filled. There is much deposit in the fields farther to the west, and a *puteus* has

¹ i.e. 4.50×1.61 .

² They are marked as *cippi* on the map; but there is one *cippus* below them, a block of tufa, 0.92 m. long, 0.57 m. broad, 0.24 m. thick, with a hole in it 0.15 m. in diameter.

³ *PBSR.* iv. 121.

⁴ Cf. Lais, *Acqua Mariana*, 15; Cancogni's account in *Boll. ass. arch. rom.* ii (1912), 190, is inadequate.

⁵ This is close to the villa marked in *PBSR.* iv, map ii, at point 111.

⁶ *Livellazione*, 1b, fig. 11.

⁷ The intrados must have been between 95 and 100 m. above sea level.

been marked in the map. From this point to Capannelle no further trace has been seen: and the course then runs on top of Aqua Claudia.

(f) *The Aqueduct of Piazza Guglielmo Pepe. Map 1.*

A well-known branch-aqueduct leads to the *nymphaeum* of Alexander Severus, now called Trofei di Mario, after the trophies removed thence to the balustrade of the Capitol by Sixtus V in 1590. It has been attributed to both Aquae Alexandriana and Iulia;¹ but the question depends on levels, and these seem decisive for the Anio Novus, even though the character of the deposit is not what might be expected.

Most valuable information on its course is given by Du Pérac, who shows² the conduit almost completely preserved between the main aqueducts and the *nymphaeum*. Indeed, he marks it as though it were a main source, lettering it AQUEDUTI. AQ. JULIA.

The arches in Piazza Guglielmo Pepe are also drawn by Piranesi,³ who shows the lower row of arches in the reinforcement. These, no longer visible, occur in a photograph attached to Moraldi's monograph, and are mentioned by Lanciani.

The concrete foundation of one of the piers, just east of the *nymphaeum*, was found on the east side of Piazza Vittorio Emanuele, about 25 m. south of Via Ricasoli.⁴ In the Piazza itself, twenty-seven piers were found, making a total of thirty-four piers extending over 365 m. Not all the piers have the same dimensions, for their bases increase in direct proportion to the height of the arches. In the Piazza Guglielmo Pepe they measure 2.90 by 2.95 m. at the base, increased to 3.90 by 4.30 in three piers; these have been strengthened at a later date with a double row of arches, at 8.47 m. and 20.73 m. from the ground. The level of the *specus*⁵ on these arches⁶ was found to be 64.33 m. by Ing. Nosei, which makes it quite impossible that it can have conveyed any water but that of the Anio Novus.

The monumental fountain, where the water-supply emerged, has often been drawn by Renaissance architects and appears in many not very informative views.⁷ Fabretti attributed it to the

¹ Lanciani, 171: 383, as also in our Map 1; to the Iulia, in the *Livellazione*.

² *Urbis Romae Sciografia*, 1574: *Vestigii*, 26, shows only a few arches near the *nymphaeum*.

³ *Castello dell'Acqua Giulia*, i, figs. 2, 3; ix.

⁴ Cantarelli in *Bull. Com.*, 1917, 235.

⁵ Lanciani gives the level of the bottom of the *specus* at the Trofei di Mario as 63.45 m.; but he must have been taking a different starting-point, for he gives the level of the Iulia at Porta Maggiore as 63.739 m., which is a great deal too high; see p. 141 n. 6.

⁶ The Einsiedeln Itinerary notes hereabouts an arch by which this branch crossed a road, and calls the aqueduct itself *Forma Claudiana*. See *Itin. Eins.* 6. 2; cf. 5. 3: *Mon. Linc.* i. 479; *Forma Urbis* 24; *Atti Pont.* ix. 403.

⁷ HJ. 348; Du Pérac, 115; Piranesi, *Castello dell'Acqua Giulia*, pls. ii-iv, x-xvi; *Antichità*,

Claudia, and gives a plan of it.¹ It was studied in 1822 by some of the students of the French Academy,² by Canina,³ by Durm,⁴ and by Garnand.⁵ There is no doubt that the famous trophies which decorated it belong to the period of Domitian;⁶ but the monument itself is of brickwork assignable to Alexander Severus,⁷ and appears to be represented on his coins.⁸ Spaces for lead pipes may be seen in the walls of its passages; but they only serve jets connected with it, and are not connected with a system of distribution beyond it. Lanciani thought, however, that the water was not allowed to run to waste, but was taken to distributing-cisterns at lower levels.

I. xxvi, i; *Vedute* 34 (third), a plate also often included in the *Trofei d'Ottaviano Augusto* (Focillon 135). Rossini, *Antichità romane*, ii, last plate but four, *veduta del Castello dell'Acqua Giulia*.

¹ 26; 21, tab. ix. The level of the Claudia is 25½ feet above that of the Aqua Marcia (cf. *Columna Traiana*, 104).

² Nibby, *R.A.* i. 358; cf. *Bull. d. Inst.*, 1844, 93; also *Monuments Antiques*, ii, pls. 176-7.

³ *Edifici*, iv. 234, 235, 265.

⁴ *Baukunst der Etrusker und Römer*, fig. 543.

⁵ D'Espouy, *Fragments*, ii, pls. 63, 64, with a restoration on pl. 65. There is little doubt that this is the restoration of Garnon (*sic*) alluded to by Hülsen-Jordan (*Top. der Stadt Rom*, i. 3. 348, n. 13 *fin.*) as unpublished.

⁶ For further details see Platner-Ashby, *Top. Dict.*, s.vv. *Nymphaeum*, *Nymphaeum Alexandri*.

⁷ The brick stamp of 9 B.C. which Piranesi asserts that he found in one of the bonding courses is more likely to have been misread than to be an absolute invention, as Marini (*Iscr. Doliari*, p. 395, no. 1) and Hülsen (*Top.* 349, n. 15) think. The stamps found by Lanciani when restoring the building were on tiles in the vault of the outlet of the fountain, not in the actual core of the structure: they belonged in part to about A.D. 123-6 (*CIL.* xv. 37), in part to the beginning of that century (*ibid.* 639). The channel may, as he says, have belonged to an earlier period than the fountain itself, or older tiles may have been used in it.

⁸ Cohen, *Méd. Imp.*, Alex. Sev., 297-303, 479, 480, dated to A.D. 226. Some correction to Cohen's observations is desirable. The monument shown on the coins is certainly a great fountain, not '*Thermes*', as stated in the commentary to nos. 297-303. On the other hand the fountain is not what is meant by *Aqua Alexandriana*, which Cohen (p. 400) translates as *fontaine* (*sic*) *Alexandrine*.

X. AQUA TRAIANA

THE construction of this aqueduct is not mentioned by any ancient writer.¹ But there are two contemporary records of it. About a third of a mile before the junction of Via Clodia and Via Cassia, on the left of the modern road coming towards Rome, a *cippus* of the aqueduct was found in August 1830, slightly heeled over, but on its original site.

The text, now to be seen in the Lateran Museum, is as follows:² (Imp) CAESAR | (divi) NERVAE. F. N(erva.) | (t)RAIANVS. A(ug.) | GERM. DACIC. | (po)NT. MAX. TR. POT. XIII | IMP. VI. COS. V. P.P. | AQVAM. TRAIANAM | PECVNIA. SVA | IN VRBEM. PERDVXIT | EMPTIS. LOCIS | PER. LATITVD. P. XXX. .

The date of the inscription is A.D. 109, and to this year may also belong a coin,³ whose reverse bears the personification of the aqueduct as a river-god reclining under a vault supported by two columns and decorated with antefixae for its whole length. He holds a reed in his right hand, leaning his left arm on an urn from which water flows. The inscription on the obverse reads IMP. CAES. NERVAE. TRAIANO. AVG. GER(manico) DAC(ico) P. M. TR. P. COS. V. P. P.; on the reverse is S.P.Q.R. OPTIMO. PRINCIPI. S. C.;⁴ and in the exergue is AQVA TRAIANA.

The aqueduct is referred to in the *Liber Pontificalis* in the life of Felix II (355–8), one Felix (not the Pope) having been martyred near it and the Walls of the city.⁵ It is also mentioned in the appendix to the *Notitia*, and in the catalogue of Polemius Silvius; while an inscription built into its *reticulatum* facing and seen in the seventeenth century, records repairs by Belisarius⁶ after it had been cut by Vitiges in 537.⁷

Pope Honorius I (625–38) built a mill near S. Pancrazio on the Via Aurelia, at the lacus (?) Traiani (probably a fountain fed by the aqueduct) close to the walls of the city and the channel which brought water from the Lake of Bracciano, and below it a channel to take the water to the Tiber.⁸

¹ Frontinus must have died in A.D. 103 or 104 when the younger Pliny succeeded him as augur (Plin., *Epist.* iv. 8. 3; x. 13); he was superseded as *curator aquarum* even earlier, see p. 20.

² *CIL.* vi. 1260 = 31567 = xi. 3793, copied for Fea by Giacomo Palazzi, architect of Acqua Paola, 6 Sept. 1830, Fea, *Bull. d. Inst.*, 1830, 220; *Storia delle acque*, 266; *Diss. acc. Pont.* i. iv. 173; *Misc.* ii. 205. The stone is 1.56 m. high and 0.42 m. thick, of travertine. Bormann in the last-named passage wrongly refers it to the aqueduct which was built for the use of Forum Clodii, *ibid.* 3300, which last inscription Tomassetti (*Campagna Romana*, iii, 79) equally refers to the Aqua Traiana; Bormann also copied the inscription on the side 'C(amerlengato di) SS(antissima) R(omana) C(hiesa)' as though it were ancient. The discovery is described as follows: 'fu sterrato nel greppo contiguo da' lavoratori della strada di Bracciano, che rimane nell'andamento dell'acquedotto, un terzo di miglio circa a destra' (coming from Rome) 'dal luogo detto La Conetta nella diversione della strada corriera circa le 10 miglia da Roma.' The 'conetta' is the wayside chapel of the Madonna di Bracciano at the junction of the two roads.

³ The fifth consulate puts it between 103 and 111; Mattingly and Sydenham, *Roman Imperial coinage*, ii, Trajan, 463, 607–9, the later group is dated to A.D. 112–114.

⁴ Cohen, *Trajan*, 20–5. ⁵ *Lib. Pont.* i. 211, *iuxta muros urbis, ad latus forme Traiane.*

⁶ *CIL.* xi. 3298 (*infra*, p. 302). There is no record of repairs by Stilicho (*Lanciani*, 74: 286). ⁷ Procop. *B.G.* i. 15, 19.

⁸ *Lib. Pont.* i. 321, 327 n. 20; cf. Jordan, *Top.* ii. 225, 226. The passage is apparently interpolated; see *Mem. Am. Acad.* i (1917), 61.

The channel was cut by Aistulf the Lombard in 752, and Hadrian I, in 772, undertook extensive repairs, making it supply once more the Atrium of S. Peter's, an adjacent Bath, and many mills on the Janiculum.¹ His work does not seem to have been very effective: for Gregory IV (827-44)² had to repair the aqueduct once more, after it had, we are told, been broken and ruined for very many years. Similar language is used of the work of Nicholas I (858-67)³ after the Saracen invasion of 846.

CASSIO⁴ enumerates the various springs used to supply Aqua Traiana, on the west side of Lake Bracciano. They 'came from three different directions, and were more numerous than at present because those which came from Fosso di Fiora are lost.⁵ From the side where is now the village of Oriolo . . . in the place called Fonte del Giugnale, seven springs rose, and are still copious, being gathered together in several reservoirs, called Greca, Spineta, and Pisciareello. Several others form a branch towards Bassano . . . at the foot of the Colle di S. Maria, where five springs emerged from Fonte Cerasaro; two more above the Fosso della Spina; four entered the same valley and united in the cistern opposite Trevignano; three met in the branch of the Ferriera, and are now increased by five, that issue forth from the five reservoirs, hence called the Bottaccio (large reservoir). Here, at the Via Clodia, which runs round Lake Bracciano, all the three branches of the springs above mentioned deposited or rather purified themselves in the reservoir opposite Trevignano, already mentioned.'

The only remains detected by the author are about 125 m. due east of the ruined chapel of S. Fiore, and east of the railway to Viterbo, between the stations of Manziona and Oriolo, but nearer the latter, about 300 m. south-east of *casello* 51, 144. Here, just where a track branches eastwards from the north and south track marking the communal boundary between Bracciano and Oriolo, the aqueduct is crossed by the Fosso di Fiora. About 10 m. down-stream from the crossing, the stream has broken into the *specus*, and falls some 15 m. into a deep pool here. The outer *specus* supporting-wall is exposed for a height of 10-15 m. and a length of 10 m. It is built in the usual brick and *opus reticulatum* with an admixture of ashlar below, but is liable to be covered with thick vegetation. The *specus* is 0.91 m. wide, running east and west: the thickness of its walls was not measured, but is probably 0.65 m. or so, as at Vigna Orsini. The tufa *reticulatum* cubes are

¹ Cf. *Lib. Pont.* i. 504, 505.

² *Ibid.* 508.

³ *Ibid.* 510.

⁴ Cf. Nibby, *Analisi*, iii. 259.

⁵ These still exist, having been spared by the modern aqueduct, and Holste saw them; *Ad. Cluv.* 524. 21, 'Prope [to S. Liberato] fluit Flora amnis unde olim Sabatina aqua concipiebatur, ut ex vestigiis maximus veterum aquaeductuum apparet.' Cf. 526. 11 (when he speaks of Vicarello) 'aquaeductus Romani a capite Florae amnis eo pertingebant'.

0.07 m. square, and stand upon three brick courses. The outer wall has a band of *opus reticulatum* below the three courses, followed by five brick courses standing on unfaced concrete. At another point two blocks of cut stone are visible, both well below the *specus* level, which must be something like 320 m. above the sea.

The author could find no further fragment of the aqueduct in going down the valley of the Fosso di Fiora, though it might be worth searching further at its junction with the present main line at the Vigna Grande. The aqueduct must in fact be falling very rapidly indeed, from 320 to about 200 m. in not more than 2 km.; and, since the Fosso di Fiora is cut by no side valley in which the channel might come out to daylight, there is little probability of finding anything.

No trace of antiquity is to be seen at present in the collecting basin of the Fosso di Boccalupo (the uppermost springs of which feed the present Acquedotto di Bracciano) or in the Acqua Paola, as yet without branches, from Fosso di Ponte Nuovo to Vigna Grande. It must remain doubtful whether these springs were used for the Aqua Traiana or not. But from Vigna Grande northwards (only on reaching the east shore of the Lake Bracciano does the aqueduct begin to run towards Rome) the presence of the remains at the top end of Fosso di Fiora renders the antiquity of the present course certain, though the engineers of Paul V have obliterated almost every trace. At the head of the little valley below Casale Vigna Orsini, nearly 500 m. back¹ from the north-west end of the Lake, interesting remains exist of some 25 metres of hill-side *specus* running due west, at about 185 m. above sea-level. The outer wall, 0.65 m. thick, is of concrete faced with brick and tufa *opus reticulatum*; above the reticulate work, at the springing of the vault, is a band of six bricks, 0.31 m. high, crowned by a brick cornice 0.11 m. high. The *specus* is 1.62 m. high from the crown of the vault to the floor: the rounded vault varies in height from 0.37 to 0.43 m. The width is 0.88 m. at the springing, and 0.70 m. at the bottom, between two quarter-round cement mouldings. The channel shows no traces of deposit. The whole has been cemented over outside, possibly to prevent leakage, and runs fairly steeply downhill. At the end of the stretch there is a slight turn, and rough concrete is visible externally for 3 m.,² projecting beyond the line of the facing described.

The *specus* now followed the winding hill-side. Its outer wall

¹ Here the ancient road, of which some paving stones may be seen at intervals, kept close to the shore, and is followed by the modern one.

² On an earlier visit we found about 30 m. of the long bit accessible inside, and about 10 m. of the short; but the latter has now been filled up.

appears for about 10 m. a little farther to the south-east, running south-east, just below the modern aqueduct. The *opus reticulatum*, in two bands, is made of very hard *selce*. The interval between the two bands may have been filled with brickwork; if so, it has completely disappeared.

Arches appear to have been visible near Vicarello in Cassio's time, when Giuseppe Rosati, procurator fiscal of the water-supply, discovered part of an inscription built into the reticulate facing of the aqueduct, recording in letters 0.10 m. high. repairs by Belisarius: *Belisarius acquisivit | . . . anno p . . .*¹

From this point the Acqua Paola runs north-east to the Casale di Vicarello, still followed closely by the ancient (and the modern) road. A kilometre to the north are the Baths of Vicarello, generally (but perhaps incorrectly) identified with the ancient Aquae Apollinares, which others prefer to place at Stigliano, to the west of Manziana.² To the east of them the modern aqueduct turns east and runs along the northern shores of the lake, keeping to the foot of the precipitous hills on the north side of the crater. It runs just north of the picturesque little village of Trevignano, which juts out into the lake, with its ruined castle on the hill above.

About a mile north-east of this village, at the north end of a deep bay, close by the road, lies the chapel of S. Bernardino. Nibby noted remains of the ancient aqueduct³ to the east of this chapel, but the author could see nothing of them. There is, indeed, a large villa with vaulted substructure on the north edge of the road at point 166, but it is not likely that Nibby confused the two. Nor did better fortune attend a search for Pasqui's indication in the notes to the Carta d'Etruria.⁴ This refers to a point about 2½ km. south-east of S. Bernardino, where a small piece of the Aqua Traiana, the vault of which had given way, was visible in the path going east (really NNE.) along the aqueduct, between S. Bernardino and the Fosso del Pianoro. It was running parallel to the stream, was built of concrete faced with large bricks, and was covered by a semi-circular concrete vault. Its width was 0.80 m. Pasqui thought this to be a branch feeding the Aqua Traiana from the Logusello, a small extinct crater a couple of kilometres to the north-east. But a visit to the spot in 1927, and

¹ Cassio, i. 260: 'in vicinanza di Vicarello, oltre al Lago Sabatino, dove il collegio di S. Apollinare, o Germanico, gode un'ampia tenuta, scopri sopra un'arco dello stesso condotto una Lapide di bianco Marmo, lunga III palmi, e II larga, incastrata in muro di opera reticolata'; cf. *Lanciani*, 166: 378; *CIL*. xi. 3298, 0.66 × 0.44 m.

² Anziani in *Mél. Ec. Française*, 1913, 228.

³ Schede, ii. 67: 'circa le 10¼ m(iglia) a destra [si vedono] i ruderi dell'acquedotto Traiano sopra i quali ad un livello più alto più lungi vedesi il corso dell'acquedotto paolino'—he is reckoning the distance from Anguillara. S. Bernardino is noted as being a quarter of a mile farther on ('verso le 10½ giungesi alla chiesa di S. Bernardino').

⁴ Cartella 4, inserto 8.

a search along the path on the west of the Fosso di Pianoro revealed no trace of the channel. It is possible that he means the path on the east, but his 'parallel to the stream' would suit the west path far better. Indeed, the author has followed the whole course of the Acqua Paola along the east side of the Lake to Anguillara, without detecting the slightest trace of antiquity. Only where the aqueduct crosses the low ground north of Casale di Polline one or two doubtful cubes of reticulate were lying about; but the brickwork of the aqueduct did not seem Roman. Nibby¹ agrees that there is nothing ancient along this stretch; and its exploration can be recommended only to those in search of the picturesque, with the added caution that there is a stretch, beginning about a mile south of Casale di Polline, where the aqueduct runs along the sheer slopes above the lake and a fall is difficult to avoid.

On the other hand, Nibby saw fine Trajanic brickwork 'at the cistern where the Aqua Traiana joins the Acqua Paola'; by which he meant the junction of the branch from the Lake with the Acquedotto Paolo, which we have been following. The place lies about 500 m. east of the actual intake at the Lake,² inscribed by Pius VI: but there are now no traces of antiquity.³ To find it, proceed about a kilometre north of the straight road, almost certainly on an ancient line, going due east from Anguillara. The aqueduct follows this road for a little way, and then, at Mola dell'Arrone, strikes off to the south-east, keeping the valley of the Arrone until just before the railway, where it runs east for a kilometre before turning south-east again.

About a mile south-east from the railway-station of Cesano, the Aqua Traiana had a fine bridge over the Galera river, hereabouts called Fosso di Cesano. This is indicated, conventionally, in the map of Eufrosino della Volpaia,⁴ which shows three ruined arches and traces of a fourth on the left bank of the stream, between it and the road from Anguillara to Galera. The Torre dei Venti,

¹ *Schede*, cit. 67.

² It is this admixture of water from the lake, which is due to Paul V, that has resulted in the water rightly acquiring a bad reputation, as, e.g., in Jordan-Hülse, cit. 629.

³ *Schede*, cit. 66. $\frac{1}{3}$ (di miglio) dopo l'Arrone giungemmo al castello dell'acqua Paola dove riceve l'acqua del lago, sul quale è l'arme di Pio VI e quest'iscrizione "*Pius VI Pont. Max. formam aquae Paullae scatebris dilabentibus decrescentem . . . a capite ad milliarium XX fontibus corrivatis restituit castellum aquae Sabatinae aggestu arenae coarctatum mole intra lacum muniri iussit* A.D. MDCCXC." Il molo del quale parla l'iscrizione costruito di palizzate si vede a destra nel lago presso il castello. Lasciando il castello e prendendo la direzione ad oriente, circa $\frac{1}{3}$ di miglio dopo trovasi la botte di riunione dell'acquedotto Traiano col Paolino: la costruzione dell'acquedotto Traiano laterizia è bellissima: da questo punto andando verso mezzogiorno un mezzo miglio dopo trovasi una torre del secolo XV presso il ponte dell'Arrone [this tower is marked in the map (Carta d'Italia f. 143 ii N.O. Anguillara) about 200 m. north of the bridge over the Arrone].

⁴ *Mappa della Campagna Romana del 1547 di Eufrosino della Volpaia*, Rome 1914, 70.

a ruined tomb to the west of Cesano station, is even more magnificently depicted. At the base of the arch over the stream in the modern bridge there are some courses of tufa ashlar,¹ which may be ancient but have much more probably been relaid. The next pier to the east is of concrete, faced with Trajanic brickwork, and is 2.08 m. broad. On both sides numerous fallen pieces of concrete may be seen, but no traces of *opus reticulatum* are to be recognized, almost as if the old bridge had been removed by blasting. On the modern bridge is seen the following inscription:²

Paulus V. Pont. Max. formis aquae Alsietinae olim ab Aug(usto) Caes(are) extructis mox collapsis ab Hadriano I Pont. Max. instauratis iisdem rursus vetustate dirutis opere subterraneo et arcuato restitutis aquam ex agro Bracciani ditionis Ursinorum salubrioribus fontibus derivatam in urbem perduxit Ann. Sal. MDCVIII Pont. IV. The ground-level at the west end of the bridge, probably just where the arches begin, is 146 m. above the sea; this gives a fall of 40 m. from Vigna Orsini, a distance of about 22 km., or 1 in 550, or about 1.82 ‰.

The aqueduct now turns almost due south, and is followed by the railway until it reaches Via Clodia, between the twelfth and the thirteenth ancient miles from Rome. No traces of antiquity are to be detected in this stretch; and, after the point where the railway crosses the road, the rising ground compels a subterranean course. This continues past the junction of Via Cassia with Via Clodia, keeping to the north-east side of the road; and, according to a manuscript quoted by Lanciani,³ the ancient *putei* were found choked but intact, and were used again. When the Via Triumphalis joins the Via Clodia (now wrongly called Cassia) it turns due south to follow the former, first on the east, then on the west, and then on the east again. Presently it continues in a southerly direction along the east side of the ancient road, formerly called Strada del Pidocchio, and now Via del Pigneto Sacchetti. When this road was cut by the railway to Viterbo in 1891, the restored *specus* was brought to light,⁴ but no ancient work was found. The base of a *cippus* was, however, found *in situ* in the bank on the east of the road, about 3 km. farther south, below the *casino* of Vigna Zanni, 40 m. north of the junction of Via del Pigneto with Via Cornelia. The stone was 0.73 m. wide and 0.46 m. thick: only the lower third was preserved, and this was planted in a mass of concrete parallel to the aqueduct, 4 m. from its centre. As Lanciani has pointed out, the distance from the

¹ The blocks measure (from the bottom) 0.80, 0.665, 0.56, 0.55 m. high.

² Nibby, *Analisi*, iii. 262, mistakes the date, which he gives as 1611, and points out Paul V's error in calling it Aqua Alsietina. Cf. Paul V's bull, cited above, p. 88, n. 10.

³ *Cod. Corsin.* 932, f. 151, *Lanciani*, 164: 376; cf. De Montauzan, 285.

⁴ Lanciani, *Bull. Com.*, 1892, 289, calls it 'di fattura recente'.

centre added to the thickness of the *cippus* gives 15 feet, half the width of the strip of ground that Trajan purchased for the aqueduct. The whole strip, as along the other aqueducts, was 30 feet wide. In 1892, Lanciani¹ noted that 'perhaps the *cippus* had an inscription, but the upper part of the stone, on which it was cut, had been broken by hammer-blows long ago'; in 1905, he expressed the opinion that, like the *cippi* of the Claudia, it was uninscribed.² The stone is still visible at the road side, the top having evidently been knocked off.

From Osteria del Pigneto the aqueduct follows the east side of the road for a little way, and now passes underneath it only just below the surface, which rises in a hump as it passes over the aqueduct. It is difficult to believe that this is the original arrangement. Passing then below the Via Aurelia Nova, it follows the east side of the Via Torre Rossa, and then turns south-east along the north-east side of the Via Tiradiavoli,³ joining the Via Aurelia at La Tedesca. After crossing this road, it keeps on its south side, being visible both along it and in the garden of Villa Doria Pamphili. The last piece of its channel is to be seen where the Via Aurelia climbs a short hill, near the gate of the Villa.

At the end of the seventeenth century Eschinardi⁴ noted, outside Porta S. Pancrazio, the remains of an ancient channel, much higher than the Acqua Paola. He believed this to be the Alsietina, a most improbable supposition, but did not precisely fix the spot. Cassio,⁵ seeking it, was unable to find more than a piece along the north wall of Villa Corsini, opposite Villa Marescotti, less than a quarter of a mile outside the Gate. It was three *canne* (6.69 m.) long, oval in shape, the large diameter just under four palms, and the smaller three. Lanciani⁶ rightly considered it not Roman, oval channels being unknown among ancient aqueducts.⁷

A length of the Aqua Traiana was found in 1912-13, while digging for the foundations of the American Academy in Rome,⁸ just inside the Porta S. Pancrazio; and that part of it which lies under the Academy, 26 m. in length, between points A and B, has been made accessible from the basement. The channel was made partly by tunnelling, partly by 'cut-and-cover' work; it is

¹ *Sched. Vat.*, 37, f. 14.

² *Bull. Com.*, 1905, 291.

³ The road was so called after the old legend that Donna Olimpia Pamphili's coach was drawn by devils. Piranesi has a fine view of the *specus* here, *Antichità*, i. XII. 1. Cf. Lanciani, 164 : 376 and *Sched. Vat.*, 37, f. 149, where he notes that the modern aqueduct diverges from the ancient line below the Casino Pamphili, and that the cement lining was 0.041 to 0.038 m. thick. Some *peperino* ashlar which is seen in the modern wall supporting the road below the Villa Pamphili for a length of 4.40 m. has probably no connexion with it.

⁴ *Agro Romano*, 199: 136.

⁵ i. 194.

⁶ Lanciani, 166 : 378.

⁷ Fea thought that Eschinardi saw part of Aqua Traiana, *Storia delle acque*, 36.

⁸ Van Buren, *Mem. Am. Acad.*, i (1917), 59-61.

0.95 m. wide and 1.37 m. high to the spring of the rounded vault, which is 0.40 m. high¹ and in unfaced concrete (Fig. 33), the walls of the *specus* being faced in reticulate work. The fall was found to be 0.30 m. in 26 m., that is, 1 in 86.66 or 0.115%. The aqueduct lay 7.84 m. below the modern ground level at the point A; but at point C, some 30 m. farther east, it came to the

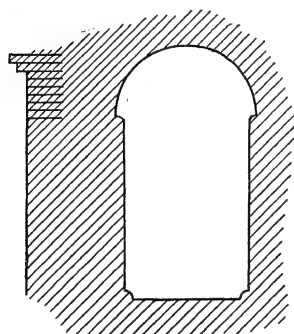


FIG. 33.

surface, and was found to be heading straight for the *casino* of Villa Spada, which is believed to have been built on some ancient remains² connected with the aqueduct, probably forming part of the monumental fountain.³ From the bridge near Cesano (146 m.) to the American Academy, where its level was taken as 73.71 m. above sea-level, we have a fall of approximately 72 m. in 23 km., that is, 1 in 319.3 or 3.13%.

Remains of the mills on the Janiculum,⁴ fed by a channel roughly parallel to the Aqua Traiana, were found in 1880,⁵ and are described from Lanciani's notes by Van Buren.⁶ But the discovery of the *specus* below the American Academy shows that it cannot, as Lanciani had believed,⁷ have been the main channel. It is, however, unfortunate that the discovery of the subterranean *specus* of Aqua Traiana, 1 m. wide and 1.90 high, 'at the highest point of the quondam Villa Sciarra on the Janiculum, at a short distance from the old entrance of Villa Spada', which is summarily recorded by Lanciani,⁸ has not been noted by other writers; nor has it found its way into any plan, not even into the *Forma Urbis*.

The great Fountain of Paul V above S. Pietro in Montorio, which forms the main termination of the Acqua Paola, is too well known to need description. But it is less common knowledge that part of it supplied, and still, in the author's belief, supplies many of the fountains in the Vatican, parts of the Palace itself, and also the Borgo and Lungara. It replaced in this function the

¹ It should be noted that above point A it is rather larger. The measurements are not given in the text, and have therefore been determined by scaling off on fig. 1 of plate 15.

² Lanciani, 165: 377.

³ It was cut through again near point C in 1927, and pieces of its *opus reticulatum* work with the cement lining were placed in the museum of the Academy. *Mem. cit.* vi (1927), 137.

⁴ See Platner and Ashby, *Top. Dict.*, s.v. *molinae*.

⁵ Lanciani, *Sched. Vat.*, 37, f. 14.

⁶ *Op. cit.*; cf. *Mem. cit.* vi (1927), 139.

⁷ *Forma Urbis*, 27.

⁸ *Not. Scavi*, 1886, 52. There is no mention of it in his notes.

Acqua Felice¹ conveyed thither by Clement VIII, which was cut off when the flood of 1599 broke Ponte S. Maria, ever since called Ponte Rotto.

At Monteverde, above the new station of Trastevere, some remarkable remains were found in 1923, attributable either to Aqua Alsietina or to Aqua Traiana.² They were fed from an aqueduct *specus* which continued for 130 m.,³ with a vault almost entirely collapsed. It was 0.75 m. wide at the base and 0.60 m. at the impost of the vault, and 1.15 m. in height.⁴ At the mouth of the *specus* traces of a sluice for regulating the admission of the water into it were visible. The walls, faced with hydraulic cement 0.03 m. thick, were 0.60 m. thick, built of concrete formed of chips of tufa, mortar, and local sand, and were mostly preserved to a height of about 0.40 m. The bottom was of cement 0.10 m. thick, with the usual quarter-round moulding at the angles; it rested on a bank of cretaceous earth. This *specus* fed through a sluice a branch channel 1.80 m. wide and about 8 m. long, with walls of unfaced concrete, 0.55 m. thick, lined with hydraulic cement (*cocciopesto*), of broken tiles or *amphorae*, 0.02 m. thick. The bottom was a bed of concrete, 0.60 m. thick, capped with hydraulic cement, 0.10 m. thick. The branch supplied a remarkable fish-nursery, a large rectangular tank, 42 by 19 m., lined with large *dolia* in which the fish could spawn.⁵

Levels taken in the main *specus*, on a stretch of 45 m., gave heights above sea-level, at the upper end 49.12 m. and at the lower end 48.47 m.; the fall was 0.65 m., that is, 1 in 69 or 14.2 ‰. The *specus* of Aqua Alsietina at the American Academy lies at about 71 m. above sea-level, and that of Aqua Traiana at 73.71 m. The distance to Monteverde is about 2,000 m.: thus, even if the *specus* ran straight, the fall, if maintained, would enable either aqueduct to have reached that point.

¹ *Arch. Borghese*, iv. 285, f. 71: 'L'Acqua Paola condotta da Bracciano fa capo in due luoghi, cioè nel Janicolo a S. Pietro Montorio e nel Vaticano in Belvedere. Da S. Pietro Montorio si riparte a Ponte Sisto, a' Savelli, a' Orsini, in Trastevere, et altri luoghi. Da Belvedere si riparte dentro al Palazzo Alli Torrioni—a piede alle scale: dentro al giardino: alla fontana isolata: alla Musaica: alla Palazzina: alle statue: all'innocentio: alla Cleopatra: alla Peschiera grande sopra la Galleria: alla Vignola: alla Libreria: nel Teatro: alla Panatteria: alli svizzeri. Fuori del Palazzo sotto il Porticale di S. Pietro: nella Piazza di S. Pietro: alla Piazza de Sigr^e Carle Borghese. Alla Traspontina vecchia. Per Borgo nuovo. Per Borgo vecchio. A S. Spirito l'ospedale. Per Borgo S. Spirito. Alla Lungara et Altri Luoghi. . . . e già vi fu condotta l'Acqua Felice dalla s(ant)a m(emori)a di Clemente Ottavo, che poi per la rottura del Ponte Sta Maria non potè continuare.'

² Mancini, *Not. Scavi*, 1924, 55.

⁴ See fig. 5 of the article quoted.

³ 1.30 in the text is an obvious error.

⁵ Mancini, *loc. cit.*

XI. AQUA ALEXANDRIANA (Maps 1, 3, 4)

THE Aqua Alexandriana is called after the Emperor Alexander Severus, who built it when he restored and gave his name to the former *Thermae Neronianae*.¹ Only the *Historia Augusta* mentions it in classical times, though it occurs as *forma Iovi* in a document² of A.D. 993. It was only identified in the seventeenth century by one Adrien Auzout³ of Rouen, a friend of Fabretti:⁴ while Fabretti himself devoted the first part of his work to proving by exclusion that no other aqueduct can be the Alexandriana, and made a very accurate map of its course. His demonstration has been generally accepted, and his description is adopted by Lanciani.⁵

THE springs which supplied the Alexandriana were later absorbed by the Acqua Felice, built by Pope Sixtus V, in 1585. The best plan of them known to the author is the rough one by Cassio,⁶ which shows all the springs tapped by the Renaissance engineers.⁷ They lay about a mile south of the fourteenth mile of Via Praenestina, under the Colle di Sassobello, north of the farmhouse called Pallavicina. The district is volcanic, and both Colle di Sassobello and Monte Falcone are largely composed of *selce*; indeed, Monte Falcone boasts the largest *selce* quarries near Rome.⁸ Springs in the same group, perhaps a little farther north, had already been tapped by the aqueduct of Gabii, probably constructed under Hadrian.

Alexander Severus seems to have used only the springs on the west of Colle di Sassobello, which rise at about 65 m. above

¹ *Hist. Aug., Alex. Sev.* 25, 'opera veterum principum instauravit, ipse nova multa constituit, in his thermas nominis sui iuxta eas, quae Neronianae fuerunt, aqua inducta quae Alexandriana nunc dicitur'. The great fountain represented on Alexander's coins has nothing to do with this aqueduct and can never have been known as *Aqua Alexandriana*, see *supra*, p. 298 n. 8.

² It appears to be referred to as *forma Iovi* in a document of 993, *Reg. Subl.*, doc. 105, p. 151, not cited by Tomassetti, *Campagna romana*, iii. 466 (cf. Volpaia, 29) which is the lease of a piece of land; 'que antea fuit paludem (*sic*) . . . posita foris porta maiore via lavicana milliario ab urbe Roma p.m. IIII in loco qui dicitur IIII. Et inter affines ab uno latere forma que appellatur Iovi . . . et a quarto via publica.'

³ He was the first to decipher the cancelled line on the Arch of Severus (*CIL.* vi. 31230); Suarez ap. Bellori, *Vet. Arcus Augustorum*, 1690, p. 16. He served on the Committee for bringing the water of Lake Bracciano to the Acqua Paola, see Rondelet, 32; Lanciani, 167-8 : 379-80. Some of his mathematical works are printed in the *Mémoires de l'académie des sciences*, Paris, 1666, 1698; see also *Divers ouvrages de mathématique*, Paris, Acad. Royal, 1698, p. 368; *Ouvrages de mathématique* (Picard, La Haye, 1731) iv. 95.

⁴ 4 f.: 6 f. 'primo enim certum in ordinem digessi, et ad unum eundemque aquaeductum pertinere deprehendi, omne opus, tam arcuatam quam substructionis supra terram . . . quod iam mihi, adhuc de hac re incredulo, . . . inculcaverat Hadrianus Auzout; . . . similis enim ubique structura, riveque latitudo atque altitudo, aliter dubitari non sinunt', cf. also Fabretti, *Diss. acad. Cortona*, iii. 234; *PBSR.* v. 421; *CIL.* x. 6884 & Fabretti, *Inscr.* 414. 367, refer to their joint discovery of a milestone at Artena: and they examined together in 1698 the junction of Viae Latina and Labicana.

⁵ Lanciani, 168 : 380 ff. ⁶ i. 320.

⁷ Fea, *Storia delle acque*, 125 (and D on plan), shows a small ancient aqueduct below the level of the pool, without further details.

⁸ *PBSR.* i. 197 ff., 236; cf. Maps 2, 3, 4.

sea-level. Sixtus V not only used them but added others from a greater distance and a higher level.¹ Between his time and the ruin of the Alexandriana, the springs ran to waste in the basin of Pantano. Two mills, one at least seemingly abandoned when the aqueduct was restored, are marked as Mola Vecchia on Map 3.

The levels over the course of 16 km. are given by Lanciani as follows, the height of the springs being uncertain, though the collecting-reservoir of the Acqua Felice is at 65 m.: Pantano, 53 m.;² Fosso di Tor di Bella Monaca, 51 m.; Tor Angela, 50 m.; Casa della Mistica, 50 m.; the valley of Casa Calda, 49 m.; Fosso di Centocelle, 47 m.; Fosso dell'Acqua Bollicante, 46 m. This gives a very gradual fall of not more than 0.438 ‰, far lower than that of the great aqueducts.

The remains of the aqueduct begin from a large vaulted chamber below the modern reservoir, marked Serbatoio in the map. It is at least 6 m. in span, and may be part of Sixtus V's work, either the starting-point of his Acqua Felice, or an overflow tank serving Mola Vecchia.³ The mill, some 200 m. away, is connected with it by a much broken channel, which represents the *ductus supernus* (A) of Fabretti,⁴ though now retaining no cement-work. Below the Mola Vecchia, this duct ran into a *piscina limaria*, very clearly figured by Fabretti. His dimensions of 46 by 36 feet (13.57 by 10.67 m.) can be checked on the length as 10.64 m., the width being at least 12.50 m.⁵ But his drawing is inaccurate in placing the openings. Opening B, from the upper aqueduct, is 0.90 m. wide, and was probably square: it is lined with tufa slabs, 0.40 m. thick at the top, 0.60 m. at the sides. It lies only 2.90 m. from the internal angle. Similarly, opening D, now enlarged by robbing of the stone slabs, is only 2.80 m. from the angle. The outfall of the aqueduct at the east end is not visible. The angles are reinforced internally by piers 0.60 m. square: the walls are 2.03 m. thick, excluding the cement lining.

The aqueduct now begins to run on substructures of *selce* concrete, from which the brick facing has been removed. After about 200 m. the substructure gives way to arches, excellently described by Fabretti.⁶ He divides these arches in the Pantano into three groups, apparently continuous; *Arcus XLV primi huius*

¹ Lanciani, 178 : 390; cf. also De Cupis, *Campagna romana*, 592, Doc. xi.

² Lanciani, 170 : 382. The Mola Vecchia, as a fact, lies below the 55 m. contour line.

³ See Volpaia, *cit.* 28.

⁴ 9 : 8; *Diss.* i, tab. iii.

⁵ Lanciani, 170 : 382 reversed F's measurements; while Canina, iv, pl. 2315 (cf. iii. 95) has copied F's illustration, and wrongly states that it is five miles out of Rome.

⁶ He is wrong in attributing to its original construction, except as reused material, two bricks, bearing the stamps *CIL.* xv. 211, 14 and *CIL.* 2313, 6, 3 which he saw in the seventh arch at Acqua Bollicante. He uses the former as a *terminus post quem*, to prove that it cannot be the Anio Vetus. The arches are marked on *Diss.* i, tab. i.

Aquaeductus (23); *Arcus LXII*¹ *in media planitie* (22); *Arcus LXVII post Stabulum vulgo Procoio di Pantano* (21) (i.e. coming from Rome). Their winding course may have been adopted to obtain a gradual fall, or because they ran between properties.

The piers are usually 8 feet (2.36 m.) square, and 12 feet (3.54 m.) apart, except in the Pantano, the *ultima vallis versus fontes*, where the interval is 10½ feet. (3.09 m.).

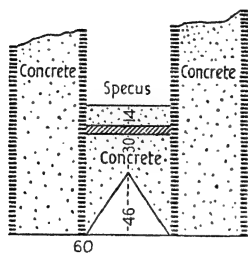


FIG. 34.

The arches consist of a single ring of tiled voussoirs, with a projecting tile round the extrados. Not all are visible, though Fabretti's total of 174 is correct. The first, tenth, and some others are blocked on each side by a huge buttress, 3.80 m. wide, projecting at least 2.50 m. But most of the buttresses are smaller and spaced at every two, or sometimes every three arches. Some arches are filled in without buttresses. These

changes cannot be much later than the main aqueduct, from which they do not differ in constructional characteristics. They seem to coincide with a raising of the level of the *specus* by 0.78 m. This was at first done by solid filling; but at certain points a triangular space, 0.60 m. long and 0.46 m. high, was left empty at the bottom to save material (Fig. 34)—a procedure unmatched elsewhere. The earlier cement lining seems to have been removed. At one point Fabretti illustrates an opening 2½ Roman feet square in the top of the *specus*, which is 2⅔ feet (0.81 m.) wide, with walls of the same thickness, and 1.80 m. high, including the gabled roof which rises from an offset 0.10 m. wide.

There are considerable overflows of heavy deposit from small leaks, noted by Fabretti; while he observes later on² that the Acqua Felice, after running for about a century, still had a perfectly clean channel.

The eighty-third arch comes near Ponte Camurrino. There are about thirty more to the second, after which occurs very poor *opus mixtum*, like that at Osteria della Spiaggia,³ facing the supporting wall and its buttresses externally, and even appearing at the top of the *specus* wall. Here the author saw the track of a lead pipe, 0.075 m. in diameter, going in under the *specus* to tap it. The filling heightening the *specus* is hereafter solid, and the early cement lining can be clearly seen.

Ten low arches are preserved just before the Casale di Pantano.⁴

¹ Not 65, as Lanciani has it. L. also mistakes the *ultima vallis*, quoted above, for the Marranella instead of the Pantano.

² 61: 51.

³ *Supra*, p. 99.

⁴ Near the Casale di Pantano the author saw four brick-stamps: (a) oval, VINIC AVIN; the first line is uncertain, but must be a variety of CIL. xv. 595, *Vinic(i) Salician(i) opus* *Sul(picianum)*; (b) rectangular, CSP, with a border of two lines, resembling (c)

The aqueduct seems to have run close in front of the Casale (to the south of it) but is gone. West of the Casale, it runs on a low substructure,¹ covered by a new road, soon lost in rising ground, and before reaching Torraccia di S. Antonio, the ruined tower east of Via Cavona, the aqueduct is well under ground. Presently, Fabretti notes a solitary *puteus* (19), then five, followed by traces of three more (18). He illustrates one of them, but his description, *opus eorum ex topko et latere alternatim compositum est*, is ambiguous. Actually, they are built of brick outside and rectangular tufa blocks within. According to him their dimensions are $6\frac{1}{2}$ by 7 feet (1.92 by 2.07 m.) outside, their side walls being 2 feet (0.59 m.) thick, so that the internal dimensions are 0.84 by 0.99 m. Only two are now left,² 72.30 m. or 243 Roman feet apart.

After the *putei*, at Fosso di Tor Angela, Fabretti notes (17) *arcus unicus ex crassis gabinis lapidibus*, of which nothing is now to be seen. It must have been either a very late restoration or a bridge on the road³ which here ran just south of the aqueduct. The *specus* of the aqueduct was seen by the author in the west bank of the stream; it was 0.90 m. wide, with rounded top, and was running south-east, but has now been concealed.

Fabretti notes that the line of the aqueduct is by no means the most direct possible. Had a straight line been kept, the arches which now become necessary in crossing the various valleys need not have been so high. But he thinks that the architect got more solid ground by going nearer the Anio, where also the red tufa is to be found, together with better material for his aggregate.

Fabretti then marks (16) four arches some way to the north-west, at the head of the extreme west branch of Fosso di Tor Angela, just east of the present Casale Tor Angela and south of Fontanile Mezzolina. They were *humiliores et fere obruti*, and are no longer to be seen. But his next group⁴ (15), *arcus xxviii, sub Casale di Tor d'Angeli viae Praenestinae propiores*, south-west of the present Casale Tor Angela, is clearly traceable, though in ruined condition. It begins with a long substructure at ground level, then a gap representing two arches, then four more arches. The pier between the first and second of these is in *opus mixtum*;

rectangular, CR, which is from the same factory, to be compared with CIL. xv, 2364-2368 (C.S.N., C.S.R., C.S.T., S.C.T., Q.S.T.); (d) rectangular, L. PROC.

¹ Fabretti no. 20 (who of course is reckoning from Rome, *nova emersio substructionis post longum rivum subterraneum, sub Casale di S. Antonio*).

² Four were traceable along the cutting of a road in 1899: and debris between the pair measured seemed to indicate that there was an intermediate one (i.e. two intervals of 120 Roman feet): see PBSR. i. 168.

³ PBSR. i. 167 and fig. 2. The pavement is now broken up.

⁴ Represented, but not with great accuracy, by Volpaia, op. cit. 25.

that between the third and fourth has been restored in bad late ashlar. To the north-west of Tor Angela a low wall runs towards the aqueduct, but seems to be at too high a level to be connected with it.

South-west of Tor Angela and of point 58, Fabretti indicates (14) *arcus unicus in medio substructionis pass. xii*. This lies at the head of the so-called Valle della Piscina, which runs down to Via Praenestina at the eighth kilometre. There is a substructure, in which blocks of ashlar have been used as foundation; and either the bottom has fallen out, or the stream has cut through it. But there never was an arch. The south side of the *specus* has fallen away; the brickwork of the rest is later and bad.

Valle Lunga is soon reached, crossed by fifty arches according to Fabretti (12), at the east end of which he notes (13), *aquaeductus ex principali dextrorsum derivatus*. This may allude to a small vent from the *specus* on the north by which the water has overflowed, leaving deposit, on to a later projecting wall of tufa concrete, 0.35 m. thick, masking earlier construction. A little farther on the original work has fallen, leaving only the later wall standing. Just east of the stream the whole structure has been rebuilt in *opus mixtum*; and one arch, built with tufa blocks and voussoirs, is blocked by still later rough, widely jointed ashlar. There is also a stone corbel in one of the arches, on a sharp turn, as Fabretti rightly observes. This may be a relic of the original construction, since no corbel appears in the rest, where the brickwork is very bad. West of the stream there is *opus mixtum* strengthening and restoration, with two arches filled up. The original brick cornice is imitated, and the width of the whole is 2.51 m. Over arch 36 from the east there is a *puteus* in the roof of the *specus*, 0.71 m. wide. The offset at the impost of the *specus*-roof has a cement quarter-round moulding which half fills it. The *specus* is flat at the top. Arch 42 contains later work and the next three have been filled up. The aqueduct gradually changes direction on the west bank, from west by south to south-west by south.

It now runs at ground-level, at about 50 m. above the sea, over a short interval, to reappear in a small valley. Fabretti notes (11) *arcus xxii in sequente valle, in gyrum dispositi*; and there is, in fact, a curious winding piece in the middle of the stretch, which consists of twenty-two low arches, robbed of their brick-facing. They were originally single, the double arches being due to later reinforcement. No tile-ribs are visible. The *specus* is 0.77 m. wide, measuring from the brick face on each side, and it is 1.33 m. from the tile offset at the springing of the vault to the tile-course under the cement floor.

The small ruined Casa della Mistica (originally a fairly large

medieval *casale*) has been replaced by a large new building. West of it Fabretti saw (10) *arcus xxviii in Valle della Marrana*. In reality there were thirty-three. There is a first group of eleven, in which the pier between arches five and six has fallen; then a gap, once filled by three arches, the last having been double; then nineteen, rounding a sharp curve. In the last group there was a *puteus*, 0.66 m. wide, over the pier twenty-five; arch twenty-six, over the stream, has been much repaired in *opus mixtum*, and thereby reduced in size;¹ and pier twenty-eight has fallen. There are stone corbels, removed at the east end, on the east bank but not on the west. At the west end the *specus* has a semicircular roof, about 0.40 m. high.

For a short distance over the next hill-top the aqueduct runs at ground level. Then follows a section (9) described by Fabretti as *arcus cii, qui duas successivas valles occupant*. They cross, in fact, the two branches of a stream on each side of Casa Calda,² a medieval tower with a farm-house. Fabretti (8) notes, on the west branch, *aquaeductus ex principali sinistrorsum derivatus sub Casa Calda*, of which the author found no trace. For the main conduit one hundred and two arches is rather too low an estimate. At first there is a long break; then a group of six arches without stone corbels, the last being double and retaining the springing of a double one beyond it. The main arches, 3.53 m. in span, with piers 2.38 m. wide, have two rings of tile voussoirs, the lower ones one: both have string-courses at the impost, and there are no bonding-courses. A long gap, representing twenty to thirty arches, now occurs; it was probably filled with double arches, for the springing of one is visible on the first arch of the next group of six, with a fragment of the lower cornice. The rest of this group are fine specimens of original construction, with stone corbels. There follow, a gap of twenty to thirty arches; then a pier, with signs of refacing and repair; an interval of three or four arches; another pier; a gap of about fifteen arches; a group of two arches; and then a gap of about five arches brings us to the west abutment, which is quite high and crowned by a medieval tower. In the last group, of two arches, some very bad late repairs are to be seen. In one arch the inner ring of tiles has partially fallen and been replaced by horizontally coursed brickwork, a third ring of tiles being added beyond, together with a new shoulder hiding the earlier corbels and the brick facing in which they were enclosed.³ The same procedure was adopted in the arch which has fallen on the east.

¹ Here there is a large mass of deposit on the north, due to a leak after the last restoration.

² *PBSR*. i. 281.

³ In the elucidation of this and other points the writer owes much to Dr. Van Deman.

¹ On the summit of the next hill (about 46 m.) the bottom of the *specus* may be seen at ground-level. The aqueduct then crossed the east branch of the next Fosso, which joins that from Casa Calda at point 28 in the Tenuta del Quarticciolo.¹ Fabretti noted *arcus xviii* (7). At the east abutment there is a solid brick-faced wall on the south, of original construction, while on the north the *specus* wall has been reinforced in *opus mixtum*, with buttresses of the same material. Some of the bricks have been carelessly set almost vertically. The *specus* is 0.68 m. wide, half choked with deposit to a depth of about 0.20 m. on each side: its walls, excluding the cement lining 0.03 m. thick, are 0.20 m. thick. The eighteen arches which follow are fairly low. The sixth pier is entirely refaced in very rough ashlar,² and similar work strengthens the little arch over the stream, embodying a fragment of sarcophagus, with 'strigil' ornament, and other pieces of marble. This work must be very late.

The aqueduct passes³ just under the next hill-top, 48 m. above sea-level, to cross the west branch of the Fosso, where Fabretti (6) saw *arcus xxiii*, but only six are now standing. These are in fairly good preservation, with travertine corbels, the usual string-mould at the impost, and two rings of tiles. Some of the brick-facing is good, as on the west side of the sixth standing pier; on the south side it is much less regular. Beyond the group of six are several fallen arches, before we reach the abutment at the west end, which, as in the valley of the 102 arches, is a substantial structure.

The *specus* then ran on at ground-level, only passing underground at the highest point,⁴ 54 m. above sea-level. Here a branch ran to the insignificant ruins to the south at point 48, where the villa that gave the name Centocelle to this district may have stood.⁵ West of point 54, in a small valley, is a low sub-structure with seven arches in the middle of it, noted by Fabretti (5) as *arcus vii modicae altitudinis in vallicula sequenti*.⁶

The finest arches in the aqueduct now occur, called by Fabretti (4) *arcus lxxxxii omnium altissimi*,⁷ crossing the Fosso di Cento-

¹ The united stream joined the Fosso di Centocelle at the fifth kilometre of Via Praenestina, the whole eventually being called the Fosso Bocca di Leone. ² Fabretti, 10 : 9.

³ To the north of it is a reservoir in *opus reticulatum* and brickwork, with buttresses on the lower side. To the north again is a small building in *opus mixtum*—a *nymphaeum* or tomb—cruciform in plan, with a barrel vault over each arm, and niches in the walls.

⁴ Here is a small reservoir just to the south of it, in which I found the brick-stamp *CIL*. xv. 1007; see *PBSR*. i. 229.

⁵ Unless it was the one at the aerodrome, *Mem. Acc. Pont.* ii. 162.

⁶ In one of these he found *in situ* the brick-stamp *CIL*. xv. 2313, b. 3—(1st cent. A.D.) which he strangely enough attributes to the time of Alexander Severus (57 : 48), whereas the *Corpus* notes it as *litteris antiquioribus*. It is a stamp which belongs to the district of Palestrina: *Sex(ti) Caec(ili) Proc(essi)*.

⁷ He notes (12 : 12) that the greatest height attained is 70 feet in several places.

celle, and mostly visible from Via Labicana. There are at first forty-eight arches; then a break of two, an isolated pier, a break of ten, seven arches, another break of ten, and five arches. This makes up the ninety-two arches given by Fabretti. Double arches are introduced where required, but neither consistently nor continuously.¹ The original brickwork is quite good, and associated with stone corbels, as elsewhere. There is later brick-faced strengthening, supported by stone corbels, at the east end on the north side: this thickens the piers and spreads on to their faces below the springing of the arches. It extends for three arches. The *specus* is here 0.72 m. wide.

There was a substructure on the north of Via Labicana, cited by Fabretti (3) as *substructio post intersectionem Viae Labicanae*, of which the line is probably marked by a boundary-fence. The aqueduct passes under the road, close to Villa Cellere, and reappears on the east of the military road, where Fabretti (2) noted *arcus lii in Valle d'Acqua Bollicante*. Fabretti² also notes, quite rightly, that both this and the next sector had been roughly and badly repaired: 'ut appareat, primam substructionem primosque arcus ad dextram viae Labicanae occurrentes, ad num. 1 et 2, a solo fuisse refectiones; nihil enim in illo opere, quod elegantiam aut mensuram residui sapiat, reliquum manet.' It was used later to carry part of the water of the Marrana.³

After crossing this valley the aqueduct, as Fabretti indicates, must have turned sharply to the north; the last traces of it towards Rome are noted by him (1) as *ultima Romam versus substructio aquaeductus Alexandrini in vinea Cartusianorum*, now the Casale della Certosa,⁴ at point 51 on the south of the road, just beyond the second ancient milestone.

No further sign of the aqueduct can be seen towards the City. The fact that it lay at only 47.07 m. above sea-level at Acqua Bollicante means that it might have reached Porta Maggiore at ground-level. No trace of it has been noted there; and nothing is known of its further course or distribution, except that it eventually reached the *Thermae Neronianae* in the *Campus Martius*, close by the Pantheon.

¹ A portion with double arches is illustrated by Fabretti (ed. i, p. 8; ed. ii, tab. ii), who gives the width of the *specus* as $2\frac{1}{2}$ (Roman) feet, the height to the spring of the vault as $4\frac{1}{2}$ feet, while the vault is $1\frac{1}{2}$ feet high. The *specus* walls are $2\frac{1}{4}$ feet thick, the piers 8 feet square, and the span of the lower arches 12 feet.

² 10 : 9; he gives the level (46 : 56) as $41\frac{1}{2}$ feet below the Marcia, i.e. 59.40-12.33 = 47.07 m.

³ 'Est quoque notandus recens sive usus, sive abusus, huiusce Aquaeductus, ubi super eisdem arcibus num. 2 nullo specu, sed rivo in rudibus excavato, hodie contrario cursu, Aquae Crabrae (sic) portio fertur.'

⁴ The situation of this vineyard is wrongly described in *PBSR*. i. 225 n. 2 as though it were on the east of the valley of the Marranella (Acqua Bollicante), whereas it is really on the WNW.

APPENDIX OF DIMENSIONS AND LEVELS¹

I. AQUA APPIA, 312 B.C.

Locality	Height	Width	Roofing	Level ²	Page ref.	Livellazione
Viale Porta S. Paolo	vault	..	53	..
" "	flat	..	53	..

II. ANIO VETUS, 272 B.C.

Vicovaro	..	0.80	vault	In. 264.24	59	IV. 17
Fosso le Giunte	..	..	gable	F. 261.57	59	IV. 16
Caposaldo 917	..	0.55-0.63	gable	In. 262.32	59	IV. 15
Tomb of Bassus	..	..	gable	Im. 260.06	60	IV. 14
Centrale Volta	..	0.87	..	In. 257.18	60	IV. 13
Fosso degli Arci	..	..	gable	In. 236.41	61	IV. 11
Villa Braschi	..	1.30	..	In. 215.80	64	IV. 10
Via di Carciano	..	0.50	gable	..	64	..
" "	..	0.74	vault	..	64	..
" "	..	0.69	gable	..	64	..
Grotte Sconce	..	..	vault	In. 213.99	66	IV. 9
nr. Ponte Arcinelli	..	1.48	vault	In. 212.60	66	IV. 8
" "	..	1.30	..	..	66	..
Mola S. Gregorio I	..	c. 1.23	..	F. 172.00	68	..
Mola S. Gregorio II	..	0.93	..	..	68	..
Mola S. Gregorio III	..	0.97	gable	..	70	..
Fosso di Caipoli	1.97	1.24	gable	In. 155.99	74	IV. 3
" " on bridge	1.80	1.20	flat	..	74	..
nr. Colle Selva	..	0.80	rock	In. 156.09	75	IV. 2
Monte Falcone	..	0.69	..	..	77	..
Pantano	..	0.89	..	..	77	..
Roma Vecchia	1.75	0.80	flat	F. 52.70	79	..
Tor Fiscale	c. 2.00	0.90	gable	F. 52.50	80	..
Via Labicana	1.60	0.80	gable	F. 45.50	80	..
Porta Maggiore	1.40	0.86	flat	..	81	..
Via Scala S. Lorenzo	1.60	0.83	flat	F. 44.55	82	IV. 1
Via Principe Umberto	1.60	0.42	..	..	84	..
Piazza Manfredo Fanti	2.36	0.62	..	..	85	..
Via Carlo Alberto	1.17	0.49	gable	..	86	..

III. AQUA MARCIA, 144 B.C.

Rosoline	1.65	0.90	vault	F. 313.65	97	..
nr. Anticoli Bridge	2.70	1.52	vault	..	98	..
Osteria d. Ferrata	2.90	1.30	gable	..	99	..
Osteria d. Spiaggia	2.25+	1.38	vault	..	99	..

¹ In noting levels the following abbreviations are used. F. = floor of *specus*; Im. = impost; In. = intrados; Ex. = extrados. These correspond to the signs *f*, *i*, *c*, and *e* of the *Livellazione*. Wherever possible the position of the floor is quoted, but it is often possible only to reach the intrados.

² Levels are not certainly determined, but the fall was lower than 0.5 per cent.; see p. 54.

<i>Locality</i>	<i>Height</i>	<i>Width</i>	<i>Roofing</i>	<i>Level</i>	<i>Page ref.</i>	<i>Livellazione</i>
S. Cosimato	..	1.14	gable	In. 289.82	102	..
"	3.30	1.14	..	..	102	..
Vicovaro	2.20-2.50	0.80-1.10	vault	In. 285.43	104	III. 32
"	..	0.90	gable	..	105	..
Fosso le Giunte	..	..	vault	In. 266.05	105	III. 30
Fosso Maiuro	3.66	0.90-1.10	gable	In. 261.17	106	III. 27
Monte Papese	..	..	..	In. 252.72	107	P. 57
Fosso degli Arci	..	..	gable	F. 241.18	109	III. 19 ¹
Monte Arcese	2.00+	1.30	..	..	110	..
Villa Braschi	1.60	0.90	flat	F. 233.54	112	III. 15
Via di Carciano	2.40	1.20	..	In. 230.44	113	..
Grotte Sconce	..	0.67	gable	In. 230.70	114	..
Acqua Raminga	..	1.15	vault	Im. 219.58	115	III. 12
" "	..	..	..	F. 193.68	115	III. 11
Ponte Lupo	2.40	1.20	vault	Ex. 185.07	118-19	III. 10
Acqua Rossa	2.08+	1.10	vault	In. 183.39	121	III. 9
Rio Secco	c. 2.40	..	..	In. 181.61	122	III. 8
Fosso Caipoli	..	..	..	F. 177.74	123	III. 7
Acqua Nera	2.35	1.04	gable	F. 163.51	124	III. 4
Roma Vecchia	1.35	0.71	flat	..	131	..
" "	1.35	0.76	flat	F. 62.97	132	..
Tor Fiscale	..	..	flat	F. 62.09	136	..
Vicolo d. Mandrione	1.65	0.75	flat	F. 59.40	139	III. 2
Porta Maggiore	..	..	flat	F. 57.77	141	III. 1 ²
Porta Tiburtina	1.95	0.90	flat	F. 54.14	147	..
Via Milazzo	2.00	0.70	gable	F. 52.57	147	..
Via Cattaneo	..	0.65	gable	..	150	..

IV. AQUA TEPULA, 125 B.C.

Caposaldo 37	1.17	0.57	vault	In. 70.48	130	..
Roma Vecchia	1.17	0.52	flat	..	131	..
" "	1.45	0.78	gable	F. 64.82	131-2	..
Tor Fiscale	..	..	flat	F. 64.09	136	..
Vicolo d. Mandrione	..	..	flat	F. 61.58	139	III. 2
Porta Maggiore	..	..	flat	F. 57.55	141	III. 1
Porta Tiburtina	1.10	..	vault	..	145	..
Via Milazzo	1.17	0.48	vault	F. 54.37	147	..

V. AQUA IULIA, 40-33 B.C.³

Caposaldo 37	..	0.59	..	F. 70.78	130	..
Roma Vecchia	..	..	..	F. 66.42	132	..
Tor Fiscale	..	..	..	F. 65.59	136	..
Vicolo d. Mandrione	..	..	..	F. 62.95	140	III. 2
Porta Maggiore	..	..	..	F. 59.04	141	III. 1

¹ At III. 19, 240.18 in the *Livellazione* is an error; see p. 109, n. 2.² At III. 1 the levels of that work were later revised by Ingegnere Nosei with a result in closer harmony with earlier measurements, see p. 141, n. 6.³ There is a divergent tradition as to the date of this aqueduct, Frontinus giving 33 B.C. and Dio Cassius 40 B.C.; see p. 161. On the high arched sectors little more than the floor of the channel is preserved, since it was the topmost member of the Marcia-Tepula-Iulia.

V. AQUA IULIA, 40-33 B.C. (*cont.*)

Locality	Height	Width	Roofing	Level	Page ref.	Livellazione
Via Milazzo	1.07	0.48	vault	F. 55.90	147	..
Via Marsala	1.60	0.46	..	..	147	..
Piazza Fanti	1.70	0.52	vault	..	150	..

VI. AQUA VIRGO, 19 B.C.

The restoration of this aqueduct to use renders impossible an inspection of the channel or an exact levelling of the course. The fall over a length of 19.04 km. (12,865 paces), from the source to Piazza di Spagna, is about 5.69 m., approximately 0.025 per cent., see p. 171.

VII. AQUA ALSIETINA, 2 B.C.

The primary source, Lake Martignano, the ancient *Lacus Alsietinus*, lies at 207 m., while the secondary source, Lake Bracciano, the *Lacus Sabatinus*, lies at 164 m., see p. 184. The known *specus* on the Janiculum lies at 71.00 m. These facts cast doubt upon the accuracy of the traditional line, suggested by Nibby. The width of the Janiculum *specus* was 0.87 m.; the height over 1.17; but the roof was missing, see p. 188.

VIII. AQUA CLAUDIA, A.D. 47.

Casello 56.257	3.00	1.31	vault	In. 314.00	194	II. 40
S. Cosimato	..	0.84	flat	In. 300.51	195	II. 38
"	..	..	..	F. 294.84	196	II. 37
Branch channel	..	..	..	F. 288.03	196	II. 36
" "	0.75+	0.90	..	..	198	..
Vicovaro Rly. Stn.	3.00	1.03	vault	F. 276.14	202	II. 33
Casa colonica	3.10	1.09	gable	F. 272.66	203	II. 30
Tomb of Bassus	..	1.07	vault	In. 274.96	203	II. 29
Fosso Maiuro	2.83	1.00	gable	In. 273.21	205	II. 27
Fosso d. Noce ¹	c. 3.50	..	vault	F. 269.17	207	II. 26
Tivoli Power-stn.	2.80	..	..	F. 255.20	208	II. 22
Grotte Sconce	..	..	..	In. 233.60	210	II. 19
Acqua Raminga	..	1.30	..	F. 219.40	212	II. 15
Forme Rotte	..	0.85	..	F. 215.75	213	II. 14
Fosso d. Inferno	..	0.84	gable	In. 216.87	214	II. 13
Ponte Diruto	3.62	..	gable	F. 177.38	216	II. 10
Fosso d. Pallavicina	3.20	1.20	open	F. 159.80	218	II. 9
Casale d. Pallavicina	..	1.16	vault	F. 157.93	219	II. 8
Fosso della Morte	2.86	1.10	vault	F. 134.60	221	II. 8
" "	1.96+	1.47-0.95	vault	In. 136.56	221	fig. 15
Fontana di Casal Moreno	2.40	..	..	F. 99.49	222	II. 7
Villa Bertone	1.63	1.05	flat	..	227	..
Roma Vecchia	1.79	1.10	flat	F. 75.00	229	II. 6
" "	1.79	1.10	flat	F. 69.78	229	II. 5
Tor Fiscale	..	..	flat	F. 69.19	232	..
Podere Saccardo	1.75	1.14	flat	F. 66.23	239-40	II. 4
" "	1.75	1.14	flat	F. 65.76	239	II. 3

¹ The Severan bridge.

IX. AQUA ANIO NOVUS, A.D. 52.

Locality	Height	Width	Roofing	Level	Page ref.	Livellazione
Subiaco	c. 1.70	c. 0.55	gable	492.53 ¹	256	..
"	1.90	0.70	gable	..	256	..
Soripa	1.55	1.83	gable	..	256	..
Ponte Minnone	..	..	..	c. 360.00— 370.00	257	..
Ponte Arconi	..	0.90	vault	In. 312.72	260	I. 72
Fosso Riorone	2.37	..	vault	F. 302.41	260	I. 66
Mandela Rly. Stn.	..	1.05	..	F. 288.44	261	I. 64
S. Cosimato	..	1.20	gable	In. 288.44	262	I. 63
Vicovaro Stn.	2.67	1.10	vault	..	263	..
Fosso Salone	2.50	..	..	F. 277.91	263	I. 56
Centrale Volta	2.50	0.95	vault	F. 270.58	265	I. 51-50
Monte Papese	..	0.85 ²	gable	In. 265.61	266	I. 45
Barberini branch, at Fosso Tufali	..	..	..	F. 255.70	281	..
Osteriola	2.20	1.22	vault	In. 252.84	271	..
Fosso degli Arci	2.60	1.30	..	In. 251.41	273	I. 36
Grotte Sconce	..	1.27	vault	In. 247.48 ³	277	..
Monte Arcese	..	1.60	gable	In. 246.31	279	I. 29
Barberini branch, at Gericomio piscina	..	..	vault	In. 243.13	281	I. 26
Fosso d. Mandorle	2.67	1.56	..	..	282	..
Ponte S. Antonio	3.12	1.00	..	In. 236.33	283	I. 24
Fosso d. Inferno	..	1.06	..	In. 229.20	286	I. 21
Via d. Zagarolo	..	1.32	vault	F. 180.90	289	I. 18
Fienile	2.83	1.30	gable	F. 180.73	289	I. 17
Fosso d. Biserano	3.07	1.18	vault	F. 173.27	292	I. 15
Fosso d. Pallavicina	..	..	gable	F. 169.51	292	I. 14
Fosso della Morte	2.02	1.10	vault	F. 136.05	294	I. 10
Fontanile Trasanella	..	1.30	gable	F. 135.90	295	I. 9
Centroni	2.40+	0.95	vault	F. 96.98	296	fig. 11
Villa Bertone	1.82	..	flat	In. 80.94	226	I. 5
Sette Bassi branch	..	..	..	F. 77.34	228	fig. 10
Roma Vecchia	1.25+	1.14	vault	F. 77.66	229	I. 4
Tor Fiscale	..	..	..	72.19	232	..
Podere Saccardo ⁴	..	..	..	F. 69.09	239	I. 2
" "	..	..	..	F. 68.63	239	I. 1
Piazza G. Pepe ⁵	..	..	..	F. 64.33	297	..

X. AQUA TRAIANA, A.D. 109.

Lake Bracciano	1.62	0.70	vault	c. 185.00	301	..
Fosso di Cesano	..	..	..	c. 146.00	304	..
American Academy	1.77	0.95	vault	73.71	306	..

¹ This is Gori's measurement; the position in the *specus* is not stated, see p. 256, n. 3.² Close by the *specus* measured 1.05 m. wide; see p. 267.³ At the lower end of the cistern there is a step of 0.43 m.; see p. 277.⁴ From this point onwards only the bottom of the channel is preserved except at Porta Maggiore; hence the lack of dimensions. The levels are important in connexion with the branch to Piazza Vittorio Emanuele.⁵ Commonly assigned to Aquae Alexandriana or Iulia, as in Lugli, *Monumenti Antichi di Roma*, ii. 364. The former at Acqua Bollicante lies at 47.07 m., see p. 315, n. 2; the latter's floor at Porta Maggiore is at 59.04 m. Thus neither can serve a level of 64.33 m.

XI. AQUA ALEXANDRIANA, c. A.D. 226.

For levels, taken by Lanciani, see p. 309. There was a very gradual fall of 0.438‰.

<i>Locality</i>	<i>Height</i>	<i>Width</i>	<i>Roofing</i>	<i>Page ref.</i>
Pantano	1.80	0.81	gable	310
Fosso d. Tor Angela	..	0.90	vault	311
Quarticciolo	..	0.68	..	314
Fosso d. Centocelle	1.72 ¹	0.72	vault	315

¹ Fabretti's measurements, see p. 315, n. 1.

ABBREVIATIONS USED IN INDEX

For the purpose of shortening references to the individual aqueducts in the foot-notes and Index, the following abbreviations have been used.

A = Aqua Appia, *AC* = Arcus Caelemontani, *ALEX* = Aqua Alexandriana, *ALS* = Aqua Alsietina, *AN* = Anio Novus, *ANT* = Aqua Antoniniana, *AV* = Anio Vetus, *C* = Aqua Claudia, *CAN* = Aquae Claudia et Anio Novus, *M* = Marcia, *MTI* = Aquae Marcia et Tepula et Iulia, *P* = Ponte *or* Ponti, *RHAN* = Rivus Herculanus aquae Anienis Novi, *RHM* = Rivus Herculanus aquae Marciae, *T* = Aqua Tepula, *TR* = Aqua Traiana, *V* = Aqua Virgo.

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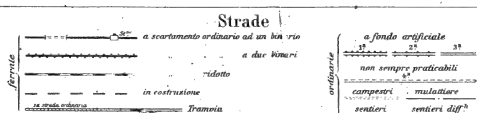
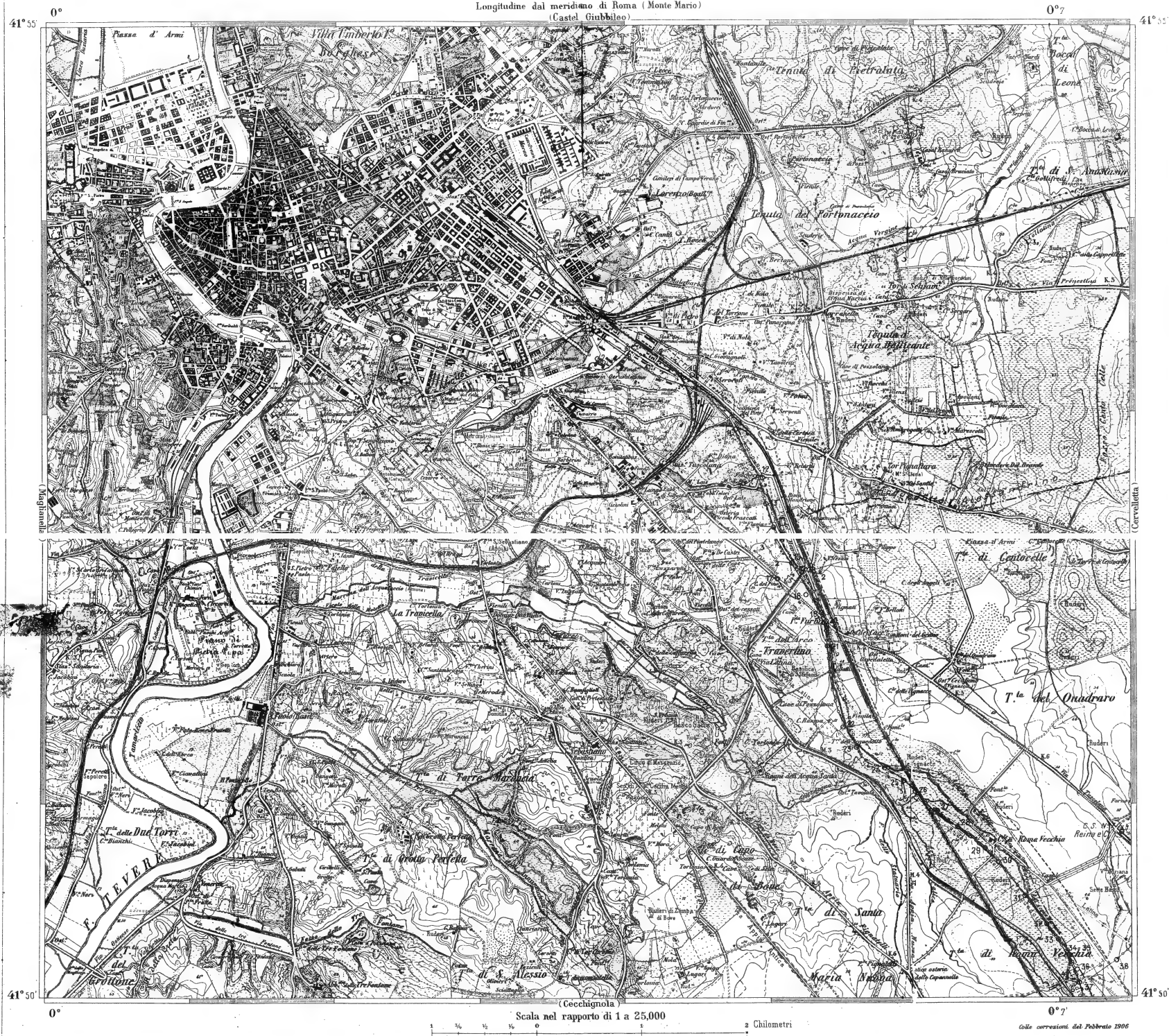
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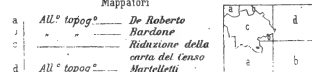
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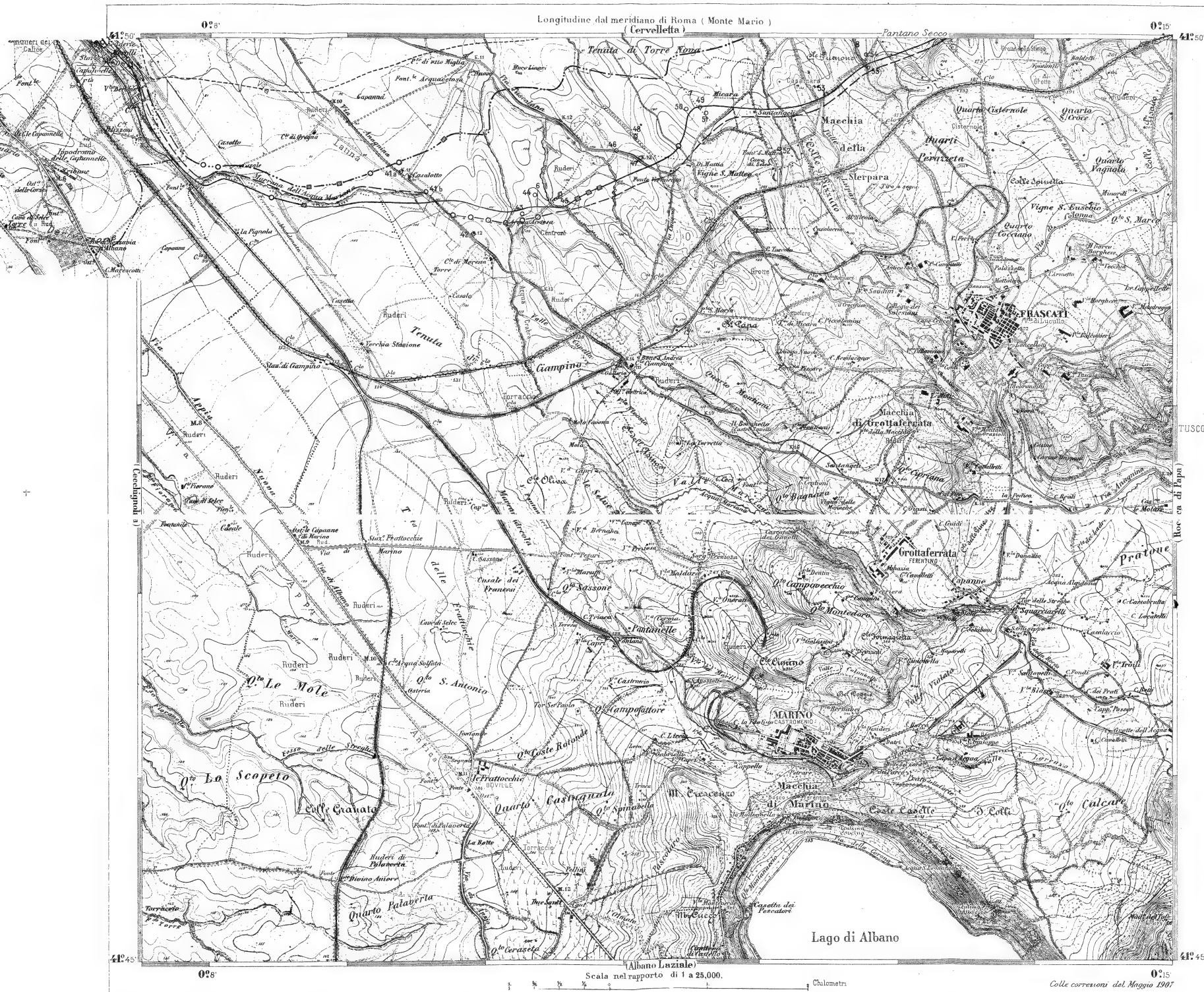
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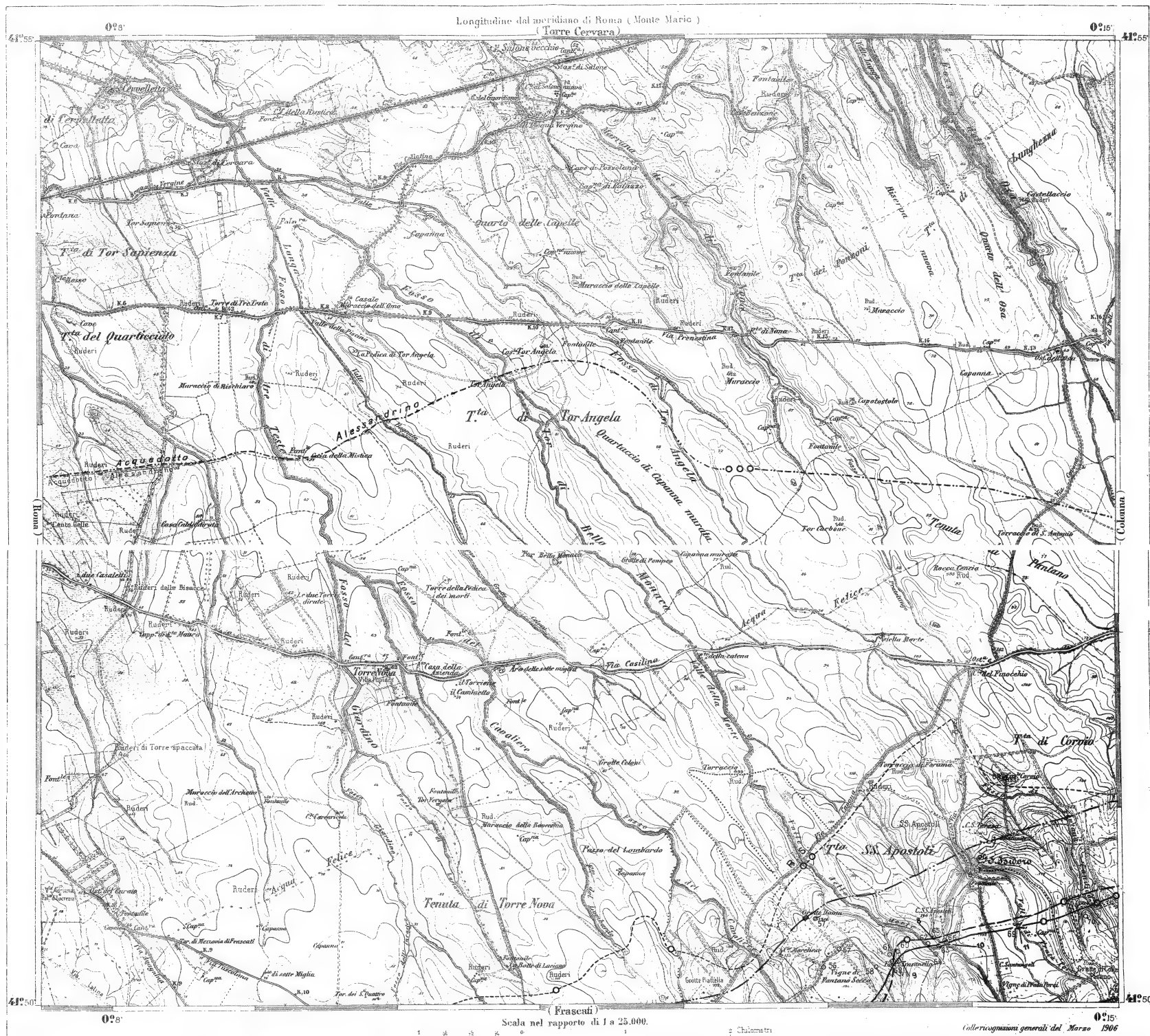


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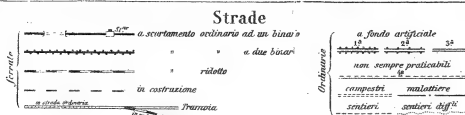
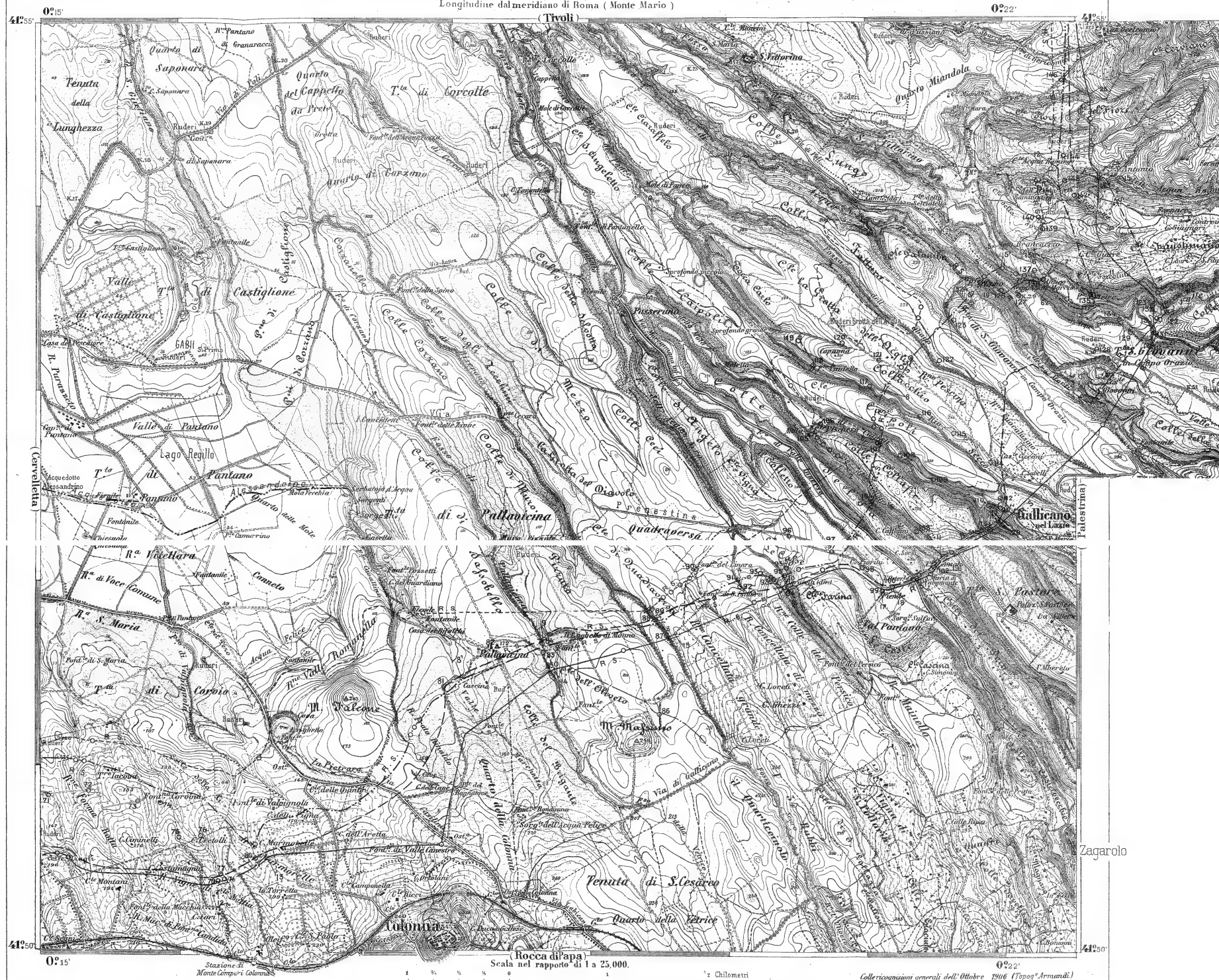


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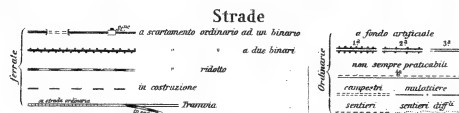
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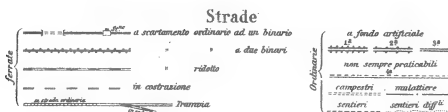
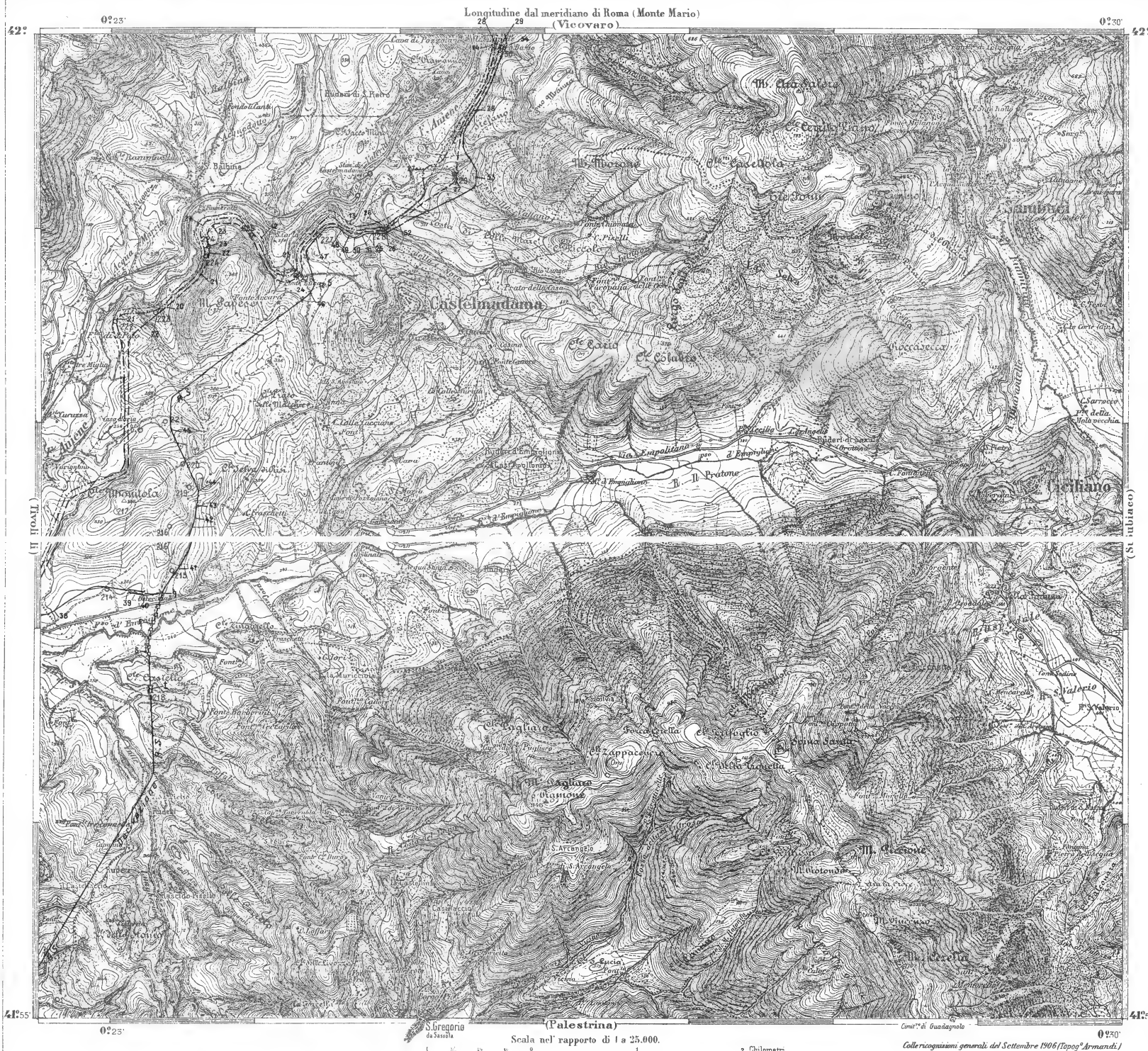
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Piscina
Cippus
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Bench Mark

a	b
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c	1876



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Tonente Brusati
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Sapio
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a	b	c
1826	1826	1826
d	e	f
1826	1826	1826



